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AEROSPACE, CIVIL AVIATION

Ariane Failure Traced to Water Pressurization System

90WS0017C Paris LE MONDE in French
10 Apr 90 p 40

[Text] The report of the committee of investigation assigned to explain the explosion behind the failure of the Ariane launcher on 23 February was made public Monday 9 April. Experts reached four important conclusions in this approximately 180-page report written under the direction of Mr Jacques Durand, director of the Ariane-5 program at the European Space Agency (ESA):

—The failure of the mission was the result of a drop in thrust in one of the main first-stage engines. It was due to the nearly complete obstruction of the water-supply circuit used to pressurize the fuel needed for the engines. The precise cause of the incident was either the presence of a foreign body in the water channel or, less likely, the failure of the main water-circuit valve.

—Furthermore, the other anomaly that occured during flight on one of the launcher's liquid booster rockets was indeed due to the beginning of a fire set off by a nitrogen-peroxide leak.

—The committee of investigation's research did not establish any correlation between the two incidents.

—Finally, the committee does not think the failure of this mission calls into question the design of the Ariane-4 launcher, which could fly again as early as this summer provided a certain number of corrective measures are taken. Indeed, the committee has written 44 recommendations, all of them accepted by Arianespace and the European Space Agency. Nine of them will absolutely have to be implemented for the next launch. Most concern ways to bolster manufacturing procedures and checks for the launcher.

Further Details

90WS0021A Paris LE MONDE in French
11 Apr 90 p 13

[Article by Jean-Francois Augereau: "Ariane Should Resume Flights This Summer"; first paragraph is LE MONDE introduction]

[Text] The failure of the European Ariane rocket on 23 February should not interrupt launchs for more than 4 to 5 months. The next Ariane flight could happen as early as the beginning of the summer. No design flaws in the launcher were turned up by the report of the committee to investigate the February explosion, which was made public Monday 9 April.

If all goes well, the next Ariane flight could come to pass at the beginning of the summer, "making it possible," according to Arianespace's president-general director, Frederic d'Allest, "to conduct four new missions between now and the end of the year." It should also make it possible to rapidly compensate for lost time and "catch up" with previous launch-calender dates near the end of 1991.

The incidents behind the in-flight explosion of the launcher and the destruction of the two Japanese telecommunications and television satellites do not, in fact, call into question the launcher's design. The report just made public by the investigating committee assigned to analyze the causes of the failure makes it clear that the functioning of the first-stage engines was not the culprit.

This conclusion should buoy Arianespace's customers, with whom Mr d'Allest wants to maintain "a policy of total openness." Doing anything else would be ticklish, with new Ariane competitors such as the Chinese launchers entering the launch-services market1. Nonetheless, judging from the four-soon to be five—contracts awarded Arianespace in the weeks following the failure, customers are still faithful to the European launcher despite all.

Stopped-Up Feed System

These successes, however, should not cloud the fact that the committee of investigation's report made 44 recommendations, essentially concerning "procedures for integrating and verifying the impermeability of the fluid-feed systems for the first and second stages and liquid booster-propulsion units" attached to the body of the first stage. This could not be any clearer. For if one of the main first-stage engines—engine D—failed to perform due to a sudden drop in thrust only 6.2 seconds after ignition, it is because its water-feed system2 was 97 percent blocked upstream.

Blocked by what? That is the great riddle. Though experts have not yet identified the precise cause of the incident, they have come up with two hypotheses: one postulating an ill-timed foreign body in the wide-diameter (40 millimeters) conduit connecting the water tank to the engines, and the other, less likely, supposing a failure of the principal water valve located upstream of the engine. The remaining doubts should be dispelled in about 10 days, for Navy divers and Paris firemen, aided by the Kourou 3rd Foreign Infantry Regiment, have pried out—under rough sea conditions—the water-tank filter, suspect valve, engine-D water pump, and a large section of the water-feed system.

Fuel Leaks

All experts need to do, then, to uncover the true culprit is thoroughly examine these parts. Few, it must be admitted, believe in a valve failure, but many are wondering about the nature of the roving body that could have stopped up the water-feed system. The puzzle is how it could have gotten there given the standards of cleaniness in effect during assembly of European rocket stages. Is it a protective plug, a scrap of sandpaper, a cleaning rag left behind by mistake? There is little

question that Ariane manufacturers are awaiting the answer with some trepidation, hoping it did not happen in their factories.

Unlocking the mystery will not solve the problems encountered by the launcher during its last launch. For only two to four seconds after ignition of the main engines, a slight fire broke out in one of the liquid booster rockets (PAL-3) of the first stage. It was caused by small fuel leaks—20 grams a second of nitrogen peroxide and less than one gram of dimethylhydrazine—which did not stop the engine from functioning properly until the launcher was lost, 101 seconds after ignition.

300 Million French Francs

Could it have held on longer? No one really knows. But despite this second incident, experts believe the 23 February mission could have succeeded if the first-stage D engine had been able to function at full capacity. All the same, checks will have to be performed to tell whether the fuel leaks observed were due to poor positioning of the gaskets used on these famous PALs or, and this would be more serious, to their very design.

In sum, this is one to watch, especially as the investigating committee reporters have invited manufacturers to shore up the heat protection of these systems to improve their resistence to fire. In the meantime, the four launchers already set in Kourou (Guyana) and in Arianespace's workshops in Mureaux will be gone over with fine-tooth combs and subjected to 20 of the commission's 44 recommendations. The cost of all this: 200 to 300 million French francs, or just under half the price of the most powerful Ariane 4.

Footnotes

1. For the first time, the Chinese successfully launched a telecommunications satellite for a foreign firm, at bargain rates.

2. This 6-ton (metric) water tank, located at the top of the first stage, cools the gas generator that maintains correct pressurization of the fuel tanks, supplies the power for each engine's turbopump, and drives the nozzle actuators. If it drops, the engine in turn operates at a lower capacity, causing...[punctuation as published] the failure of the last flight.

MBB Receives Contract for Ariane 5 Fuel Tank

90WS0018A Paris AFP SCIENCES in French
29 Mar 90 p 11

[Text] An Aerospatiale communique announced 28 March that Aerospatiale has just been chosen by the Deutsche Aerospace group's MBB to develop large high-pressure tanks for the future Ariane 5 launcher.

The tanks will be used to store helium and will be involved in the cryotechnical-stage and upper propulsive-stage propulsion systems. The development contract includes the design and rating of a new-generation tank and the supplying, over a 4-year period, of 36 units for engineering of the Ariane 5 system. Mass production will begin in 1995.

With a capacity of 300 liters, a diameter of 830 millimeters, and pressure of 325 bars, the tanks will be the biggest ever made by Aerospatiale. The new generation, which will use carbon fibers in place of kevlar and a new technology for making liners, offers a performance coefficient 30 percent higher than the previous generation's. The tanks will be made in Aerospatiale's Aquitaine facility.

Aeritalia's Future Directions Discussed

90WS0009A Paris AIR & COSMOS in French
24 Mar 90 pp 26, 56

[Article:" Fausto Cereti, vice-president of Aeritalia on Aeritalia, Increasingly International"]

[Text]

Fausto Cereti: "We must continue the EFA program"

The interview we were granted with engineer Fausto Cereti, sandwiched between his participation the previous day in a London conference on "The EFA, latest trans-national project" and his attendance last Wednesday at the "Aeropropulsion 90" colloquium in Paris where he was to speak on the three-country 100-seat aircraft project, involved seven specific points. The following is a summary of his position.

Future Amphibious Aircraft

The vice president of Aeritalia feels that all the requirements have been met for this program, the result of an initial rapprochement between Aeritalia and Dornier, to become a reality. A large number of countries are interested (Italy, Germany, Greece, Yugoslavia, Denmark, USSR, Japan, and even the French Minister of the Interior) and the E.E.C. is apparently in favor of the development of such a program because it is European and civil, because it has an ecological impact (remember it is above all a project for an aircraft to fight forest fires and combat any form of pollution), and because it favors research. So this is a particularly good time to attempt to initiate this program in the context of a series of international accords. This should be done very soon. If our action fails to achieve the anticipated success within the next seven to eight months, that will mean there is something in our project, either a technical or commercial factor, that we have failed to evaluate properly.

100-seat Aircraft

Cereti (at the request of his good friend Engineer General J. Benichou) was to discuss this topic more thoroughly in Paris last Wednesday (we will discuss it in more detail in our next issue), so his comments were brief.

The actual situation is as follows: Aeritalia, like its two currently committed partners (Aerospatiale and CASA), is certain there is a possible market in the upscale regional transport industry for a 100-seat plane that would embody a highly advanced level of technology not only in its airframe but particularly in the selected engines (General Electric, Pratt & Whitney, and Rolls Royce seem to have interesting ideas and proposals to make on this issue).

So, Cereti proposes, let's give ourselves until the end of the year for our designers to work on the technical aspect and our market studies staff on the commercial aspect. In December, we'll compile the information and see if our current feelings are accurate. They may not be, because there are many unknown factors, especially with respect to probable changes in fuel costs (not on a downward trend) and in monetary parity.

Once the product, the market, and the possible industrial agreements are reviewed, a realistic decision will be made.

The Future of the EFA

Cereti emphasized in London and reiterated in our interview that Aeritalia is giving the EFA development program high priority because it constitutes a means, especially for the company, of maintaining a high level of advanced technology.

The industrials involved are willing to admit that for economic and financial, geopolitical and strategic, budgetary, or perhaps even demagogical reasons, the program should be spread out over a period of time because of a slow-down in financing schedules; they are well aware of the need for a certain "adaptation" of future military aeronautics programs but, at least as far as Italy is concerned, the same industrials are confident their country's government will confirm Italy's participation in the EFA program, for which the development cost up to the prototype phase has been estimated at 12 trillion lira or a little less than 60 billion francs.

The need to maintain the EFA program is also justified by the fact that Aeronautica Militare Italiana cannot be deprived of interceptors and that, at the same time, it seems truly difficult to hope to extend the life of the F-104s, which have already had an illustrious career. Of course, the industrials committed to the AMX and Tornado programs have already been asked to examine the technical and financial conditions in which the list of missions initially given the pilots of these two types of aircraft could be made even longer...but the procurement of real interceptors will have to be envisioned someday. And history shows that it is always more economical for a country to purchase the equipment its armed orces need at home, rather than ordering it from abroad.

The AMX Program

During a recent visit by Cereti to the Aeronautica Militare Italiana units that have received and commissioned the first assembly-line AMX's produced by the Aeritalia and Aermacchi plants, the pilots' comments on the aircraft and its performance were even more enthusiastic and therefore a greater source of satisfaction for the producers than they might have expected. This is even better news because in their brand new planes these pilots will most probably be asked to fly missions more similar to those of a fighter-bomber in order to ensure maximum conservation of the F-104s until the EFA is placed in service.

This implies that it will soon be necessary to increase the versatility of the AMX to make it capable of completing, fully and with a good chance of success, missions that were not planned at the program's origin. This has been an itemon theagend for some time now, and this increase in AMX versatility could also help make it more exportable.

Expansion of Civil Activities

The vice president of Aeritalia has no desire to talk about transfers of activities, changes, transformation, or even diversification.

He demonstrates that his company, whose civil activities now represent 40% of overall operations, has long been highly diversified and is ready to increase that percentage even more based on demand and the laws of the market, if that is the right decision.

But that doesn't mean he thinks there should be a significant reduction in military credits and military activities, because the old Latin proverb, "si vis pacem, para bellum" ["If you want peace, prepare for war"] will still be valid for a long time to come.

The A.321 Program

On this subject, Cereti emphasizes that an agreement with Airbus Industrie is being finalized to define exactly what share of the work Aeritalia will do in the construction of the A.321: In principle, section 14 of the fuselage, but the Italian company could also be asked to build other parts of the A.321, or even participate in the production of other types of Airbus.

Already in an recent agreement, Pratt & Whitney has asked Aeritalia to manufacture the engine pods for the A.330.

In addition, through Magnaghi, a company in which Aeritalia owns 35% of the capital and which is participating directly in the construction of some Airbus elements, Aeritalia is once again associated with the production of this family of aircraft without compromising its participation in other civil aircraft construction programs.

On this last point, no figures are given. Cereti says only that the overall results will be better than had been announced: sales and profits clearly rising and, even better, a book full of orders. This will be the most meaningful result of all.

Avionics Center To Be Built in Braunschweig

90CW0171B Stuttgart FLUG REVUE in German Mar 90 p 70

[Article by Helga L. Hillebrand: "Braunschweig Builds Avionics Center—Electronics: Measuring Instrumentation From Aerodata"]

[Text] By 1992, an avionics center is to be built in Braunschweig. In cooperation with the research institute, DLR [Deutsche Forschungsanstalt for Luft- und Raumfart—German Research Institute for Aviation and Space Travel] the Federal Aviation Agency and the University, aircraft measuring instruments will be developed and environmental research will be carried out.

The goal of the Braunschweig Avionics Center is to achieve a symbiosis between science and the economy in the field of aviation, and it is beginning to take shape. The location is well chosen: only a few steps away from the Technical University of Braunschweig, in close proximity to the German Research Institute for Aviation and Space Travel and the Federal Aviation Agency, a small community of high-tech companies is being developed here. When, in 1992, the Avionics Center is completed, it will have for joint use its own, 1150 m^2 hangar for the maintenance and conversion of special and survey aircraft, and an associated 600 m^2 engineering building with workshops for flight testing, more purposefully located at the airport, and a 1000 m^2 Avionics Testing Laoratory for 50 workers near the university.

Currently, five firms are settled here. Aerodata is one of them. Others are Geometra, the Society for Geological Explorations, Metronix Measuring Instruments and Electronics, Simtec Simulation Technology and Becker Aviation Radio which, to be sure, has its main plant in Rastatt. Nevertheless, Aerodata was able to move out from the communal buildings which are currently made available to the Avionics Center by the city of Braunschweig in its Technology Park, and inaugurate the first industrial building of its own on Jan 25.

The firm was entered in the Commercial Register in 1985 but work was begun in 1986 with only five workers. The enterprise was characterized by Aerodata's manager, Dr. Peter Voersmann, in his inaugural speech, as follows: "Aerodata is not only a child of the city but it is also a child of the TU [Technical University] of Braunschweig. Namely, the firm was established by former staff members of the University who could thereby finally apply their know-how in a profitable manner." Currently there are 36 coworkers, among them engineers involved in aviation and space travel technology, electrotechnology, information technology, meteorologists and geographers.

Aerodata's most important product is the survey instrument pod, Meteopod. It has been, and will be in the future, used in aircraft-supported environmental and climatic research. An example was the outfitting of the Dornier 228 "Polar 4" with Meteopod for the Antarctic research of the Alfred Wegener Institute. In cooperation with many research institutes and the aviation component of the DLR, Aerodata cooperated not only within German space in aircraft-supported measurement of pollutants. Just a little while ago, the firm evaluated the distribution of aerial pollutants over industrial centers of the Eastern United States through a contract with EPA, the US environmental agency. Currently Aerodata's instrumentation is being deployed in an assessment program of the Federal State of Niedersachsen and in the BMFT [Bundesministerium fur Technology—Federal Ministry for Technology] project involving German ozone research.

Aerodata Is Acknowledged as a Developmental Firm

But the firm does not concern itself with environmental sensors alone. Since 1988, it has taken over from the DLR the survey of instrumental landing systems at the regional airports while this task at the international airports is being performed by the Federal Aviation Safety Agency itself.

Providing an additional supporting leg, the Federal Aviation Agency has also recognized Aerodata, since 1989, as a developmental firm whereby it can modify airplanes and certify them in accordance with aviation law. Nevertheless, during tha past few weeks, the contacts with the Federal Aviation Agency were very close for another reason: The Avionics Center received its own Beech King Air 200 which can serve as a measuring instrument carrier for research programs and should also be used in the development and testing of new avionics.

In July 1989, the German aviation establishment took note of Aerodata and the Avionics Center. At that time, the Institute of Flight Control of the Technical University of Braunschweig introduced the first fully automatic landing with the satellite-supported navigation system, GPS; on board of the Technical University's Dornier 128, was a flightworthy on-board data system for real time evaluation by Aerodata.

Italy's Microtecnica Awarded Contracts for EFA Components

90MI0176 Rome AIR PRESS in Italian
21 Mar 90 pp 663-664

[Text] Microtecnica and the aerospace consortiums that the company is associated with have been awarded major contracts for the EFA's [European Fighter Aircraft] on-board equipment. In particular, the contracts involve components that are fundamental in regulating the on- board air-conditioning system, the regulating and control valve for the pneumatic starter on the Eurojet EJ200 engine, and the control, regulating, and operating system for the air inlet guide vane on the EJ200 compressor.

In addition, Microtecnica and the consortium of companies it leads, which includes the British company Lucas Aerospace, the FRG's Nord-Micro AG, and Spain's CESA, have been selected for the starting and control system of the leading edge flaps. The system is based on an original design by Microtecnica and on the technologies developed by this Turin-based company. It is the result of experience acquired over the last 30 years in this specific technological sector through the design, development, and mass production of the Tornado's mobile wing control system and flaps; the AMX's flap control system and stabilizer; the flap control systems for the G-222, S-211, and EAP projects; and the P-180's flap control system and canard.

Microtecnica has been awarded three Eurofighter contracts (a fourth is being finalized) involving the fundamental components required to regulate the air-conditioning system. These include the adjustment valves and heat exchangers of the EFA's air-conditioning system. Microtecnica is also specialized in the development of high-technology air-conditioning systems for aircraft and thermal control systems for aircraft and space platforms. After having developed several thousands of different systems for aeronautical programs from the early 1960's to the 1980's, the company went on to design and manufacture the fundamental components of the Spacelab's active thermal control system.

In recent years Microtecnica has used its technologies in the design, development, and manufacture of air-conditioning systems for the AMX, MB-339, S-211, A-129, and EH-101, fundamental components for G-222, P- 180, EAP, and A-109's air-conditioning systems, and for the active thermal control of the EURECA [European Retrievable Carrier] space platform. Microtecnica is currently designing the fundamental components of the active thermal control and air-conditioning systems on the Columbus manned space station. The company has also been asked to design the first stage pressurization module of the new European Ariane 5 launcher. A study of the equipment required for the survival and activity of individual astronauts in outer space for the European space shuttle Hermes is also underway.

Microtecnica is a member of the consortium that is in charge of the development of the pneumatic starting system for the European fighter's EJ200 engine. Its specific task is to develop and construct the special electric valve designed to regulate the air flow to the pneumatic starter. The project makes use of the design and manufacturing experience acquired by Microtecnica in controlling complex physical phenomena, even in highly critical operating conditions such as the control valves used in the Ariane 5's liquid-gas engine. This involves the use of highly sophisticated processes and materials as the valve is designed to operate in exceptionally demanding environmental conditions, in terms of temperature and pressure.

Microtecnica has also been awarded a Eurojet contract for the design and development (with an option for mass production) of the control, regulating, and starting system of the exhaust nozzle and the air inlet guide vane of the Eurojet EJ200's compressor. The first prototypes are currently being manufactured. The technologies are based on Microtecnica's expertise in the production of hydromechanical power and regulating systems for applications.

AUTOMOTIVE INDUSTRY

Siemens Automotive Expands Sensor Production

90WS0018D Paris ELECTRONIQUE ACTUALITES in French 23 Mar 90 p 16

[Article by J.M.: "Toulouse Becomes Focal Point of Siemens Automotive Sensors"]

[Text] Starting next September, Siemens Automotive will shift its European sensor operations to Toulouse, by transferring there its German design and engineering department now located in Nuremberg. Twenty German engineers and technicians, together with their products, projects, and families, will be housed in a new building. At the same time, the Boussens sensor production plant, which has 100 salaried workers and is located 60 km south of Toulouse, will expand considerably: Its production should increase 30 percent a year, with 50 new jobs created between now and the end of 1991.

The transfer, which was announced last 9 March at the same time as the creation of a mixed CNRS-university-company lab, will help make the Toulouse sensors center an international operation, in terms of manufacture, design, and product marketing. Responsible for sensors and automated connection for automobiles, it now turns out 13,000 units a day. Siemens Automotive also has a Canadian sensor plant that employs thirty. Sensor development requires special know-how, in particular, knowledge of the extremely rugged automobile environment, and the ability to cooperate with the auto equipment supplier providing the system.

Strategic Components

"Tomorrow's" sensors include one that measures methanol content in gasoline (allowing the injection system to be optimized) and another, a "hall" effect speed sensor, that measures the rotation speed of the engine and wheels. These are strategic components on which the entire system often depends. It is thus natural that the company would devote additional resources to them. The building being constructed will have floor space of 2,000 square meters, half to be occupied by laboratories and half by offices.

Creation of the mixed research lab dubbed MIRGAS (Mixed Research Group in Automotive Systems) will bring together Toulouse researchers from the LAAS-CNRS and Toulouse National Polytechnic Institute with Siemens Automotive engineers. It will produce new designs and technologies involving all areas connected with the "automobile of the future" and its associated electronics systems: sensors, but also engines, road-vehicle feedback systems, and control, suspension, steering, and braking systems, etc.

Siemens Automotive has also added 5,000 square meters to its Toulouse design and engineering center, and opened a factory in Korea in addition to its French plants and its factories in Rengensburg in the FRG, Newport News in the United States, and Chatham in Canada. These simultaneous moves have revved up the company's activities. The steps taken should help it meet an important challenge, namely, ranking among the leaders in automobile electronics. Siemens Automobile already ranks second world-wide in ignition devices and among the top five in injection technology. Its sales from France are 1.1 billion French francs and are expected to rise 20 percent a year.

As Renix, the Toulouse site was under Renault until 1985. Since 1 January, 1989, it has belonged to Siemens following the German group's takeover of Bendix Electronics.

Italy, USSR Sign Auto Production Agreement

90MI0178 Milan ITALIA OGGI in Italian
24-25 Mar 90 p 11

[Article by Luciana Santaroni: "Fiat Acquires a Stronger Foothold in the USSR and Signs a Major Agreement"]

[Text] Fiat has taken the lead in Gorbachev's second major motorization project for the USSR. The Fiat group has virtually acquired total control of the "Elabuga Project," a perestroika plan involving an investment of over 5,000 billion lire for the construction of a major plant at Elabuga, some 1,000 km from Moscow. The plant is expected to produce 900,000 cars for the Soviet market between 1994 and the year 2000.

The new agreement between Fiat and the USSR was finalized just a few days ago, during the visit of a Soviet delegation led by the vice president of the Soviet Council of Ministers, Ivan Stepanovich Silayev, to the major Italian Fiat plants. At the end of the tour, in a meeting with Umberto Agnelli and Cesare Romiti, the Soviets redefined the agreement for the production of the A-93 that was signed in Rome in November 1989 with a view to increasing cooperation.

Under that agreement, Fiat had undertaken to cooperate (with its 30 percent share in Elaze, the company established as a joint venture with the USSR) in the development of one of the three "modules" included in the Elabuga project, namely the bodywork of the A-93. With the new agreement, however, Fiat will also be responsible for the production of two other series of vehicles: The small car known as Oka 1 and the 1300 cc model, which is scheduled for production shortly before the year 2000.

The project involves a total production of 900,000 cars, 300 per module. Fiat has been awarded the mechanization of the three series of cars and the production of the bodywork for the A-93 and the Oka.

The Soviets must still make a decision on the bodywork of the 1300 cc model, but Fiat is fairly confident of being awarded this contract as well. Meanwhile, new details on the design of the A-93 have been disclosed. This vehicle involved an investment amounting to 1.8 trillion lire and should be launched on the Soviet market by the end of 1993.

According to a Fiat press release: "During their stay in Turin, the Soviet delegation defined the styling of the new vehicle, which had been developed jointly by Soviet and Fiat auto designers. The model will be available in a three- and five-door version."

As for the Oka, however, Fiat officials limited themselves to stating that "a technical assessment program is currently underway and this will lead to the final selection of the model to be produced."

The Soviets' decision to grant Fiat almost total control of the USSR's most extensive motorization project is not only the result of more than 60 years' cooperation in the field, but also stems from the urgent need to meet a rapidly growing demand. According to figures furnished in Turin, Italy has one car for every 2.5 inhabitants, while in Hungary the ratio is one to seven, in Poland, one to 10, and in the USSR, one to 25, with a five- to six-year waiting list.

Fiat has been active in the Soviet Union for over 60 years with its Togliattigrad plant, which has produced 700,000 cars a year since 1966, and has also been active in Poland since 1932.

The subject of East-West relations was discussed by Fiat's managing director, Cesare Romiti, in an article which will appear in the next issue of "Civilta del Laboro," the official publication of the National Federation of the Legion of Honor. According to Romiti,

"there are no simple, quick solutions to the problems posed by the reestablishment of freedom and democracy in East Bloc countries."

In Romiti's view, "the prospects of a new, extended Europe must be assessed realistically. The European Community provides the most direct reference point for the peoples and governments of the East Bloc countries. It is the model of democracy and market economy they refer to and their first reference point in establishing economic relations designed to aid their development. In this context, speeding up the process of EEC unification is essential even without taking any eventual intervention strategies into consideration. In any case, the current situation is so unpredictable that these strategies would be difficult to define."

BIOTECHNOLOGY

EC Rules on Release of Genetically Modified Organisms

90WS0022A Paris LE MONDE in French
11 Apr 90 p 16

[Article by Catherine Vincent: "The Europe of Green Genes"; first paragraph is LE MONDE introduction]

[Text] There is now a European statute for the release of genetically modified organisms into nature that takes into account industrial and ecological constraints.

The news almost went unnoticed by the general public. Yet for researchers and manufacturers, it is of prime importance: after years of vacillation, at the end of March the environmental ministers of the European Community ratified two directives on the use of genetically modified living organisms. Regulation which ecologists have long clamored for and which many manufacturers decry, and that will henceforth authorize the deliberate release, after rigorous prior inspection, of genetically engineered plants and microorganisms into the environment of EC countries.

At the heart of the controversy are GMOs, or genetically modified organisms, altered "in a way that cannot be done naturally through breeding or natural recombination." The very fact they are designated only by acronym is a strong indication, if any were needed, of how crucial these biological entities have become to industries, pharmaceutical as well as agricultural.

Compared to traditional selection techniques, transferring genes to cultivated plants sharply boosts their variability since it allows genes from different species, even different kingdoms, to be introduced into the plants' genetic inheritance. This creates tremendous economic prospects, along with some risk to the environment since, according to scientists themselves, uncontrolled proliferation of "exotic" microorganisms, and even of chimera species, cannot be totally ruled out.

The directive adopted in Brussels, which concerns neither animals nor the few plants for which no uncontrolled propagation is feared, takes into account these two imperatives. The first act decrees that all laboratories, public and private, which wish to release GMOs for research and development purposes must henceforth obtain prior go-ahead from authorities with jurisdiction in the matter in the territory concerned.

To do that, they will have to furnish a technical dossier detailing the experiment and a statement evaluating "the impact on and risks for human health and the environment of the planned GMO uses." After taking into consideration observations, should there be any, made by the other EC member states, the ad hoc authorities will have 90 days to accept or reject the proposal.

The second act is touchier still: it concerns authorization to market the product, which will be made directly at the European level. Each dossier, containing the information required during experimentation "completed as necessary to take into account the diversity of sites where the product might be used", will immediately be forwarded to the authorities with jurisdiction in the matter in all member states. The latter will have 60 days to voice an objection. No product containing GMOs, moreover, can be brought to market without having been previously subjected to "the research and development stage and satisfactory field tests in the ecosystems likely to be affected by their use."

The Behavior of 37,000 Petunias

Once marketing has been duly authorized, on the other hand, no member state will be able to "ban, restrict or prevent the deliberate release of the organism into its territory" for human-health or environmental reasons. Once in effect 1, the directive adopted by the Council should thus make it possible to establish relative harmony in Europe in matters of biotechnological safety, to avoid, and this is its essential aim, "unequal conditions of competition (...) affecting the functioning of the Common Market."

This should mean an end to the fuzziness, ill-suited to technological advances, that had prevailed within the Community on questions of genetic engineering—though there is no doubt that much remains to be done to bring everyone into agreement. While Spain and Italy have not yet taken a single protective measure, release of GMOs into the environment has been strictly controlled in this way in Denmark since 1986. And legislation is stricter still in the FRG, though the country must now resign itself to relaxing its rules to stem the growing flight of brains and biotechnology manufacturers. For the first time, West German authorities gave the green light last month to a basic research experiment aimed at observing, on a large scale, the behavior in an open field of 37,000 petunias altered through genetic engineering. It was a more timid step than the one taken at the same time by Great Britain which, for the first time ever, just

authorized the commercial development of a genetically manipulated baker's yeast engineered by the Danish firm Gist-Brocades.

In this Europe of biotechnological disparities, France, Belgium, and the Netherlands have taken a middle-of-the-road approach. Over the last 3 years, upwards of 50 experiments outside the laboratory using genetically altered organisms have been conducted on French territory, mostly under the aegis of the National Institute for Agronomic Research (INRA). They were done with the prior authorization of two committees attached to the ministries of environment and agriculture, asked to consult in assessing the risks of these nature-scale tests.

Too-Limited Projects

Though the principles adopted in Brussels aim to reduce these glaring disparities, they are far from satisfying all parties, starting with the big European biotechnology companies. (These include the ICI, Sandoz Ferruzi, Rhone-Poulenc, Hoechst, Monsanto Europe, and Unilever). The latter addressed a warning in January to the EC Commission in charge of this thorny question. The gist of it was that the United States' and Japan's lead in biotechnology is already so long that Europe's future position is now in jeopardy.

A state of affairs which, according to them, comprehensive legislation will only aggravate, since most of the biotechnology projects financed by the EC are already "too limited, both in scope and method, to have real impact and give Europe a decisive profile."

The European Council did not buckle to pressure from the ecologists who, sponsored by the parlimentary group Rainbow, were asking for a 5-year moratorium on genetic engineering (LE MONDE 24 May, 1989). In the end, however, confronted with the willfulness of manufacturers, they did give some credence to the worries of environmental defenders. Though this choice does not do much in itself to compensate for the Old World's lag in this field of the future, it should give Europe relative flexibility compared to its main competitors. Indeed, until last month, there was still a moratorium in Japan banning all food or feed products using GMOs. And the situation is no simpler in the United States, where relatively lax national regulation is fueling endemic strife between manufacturers, researchers, and ecologists in several states.

Footnotes

1. EEC member states have 18 months, dated from March 1990, to implement nationally the legislative, regulatory, and administrative arrangements relative to this directive.

French Firm To Produce Soya Substitute

90WS0022B Paris L'USINE NOUVELLE in French 5 Apr 90 p 36

[Article by Christophe Belloc: "An Industrial First in Biotechnology"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Using genetic engineering, the Orsan subsidiary Eurolysine is developing a new soya substitute for manufacture. Its goal: a European market estimated at 15,000 metric tons a year.

It is a world first. While biotechnologies are far from having kept all their promises (see page 36), Orsan (Lafarge-Coppee group) is seeing 2 years of research rewarded. Eurolysine, its 50/50 joint subsidiary with the Japanese company Ajinomoto, is in fact moving into commercial production of threonine. This amino acid, in combination with lysine, replaces soya for feeding pigs and chickens. It could also find niches in the pharmaceutical industry.

The whole art consists of improving, notably through genetic engineering, the bacterial strain that converts glucose located at the beginning of the chain into threonine. And in increasing the yield of the whole conversion process (see boxed material).

Through this first technique, Eurolysine hopes to create a new European market estimated at 15,000 metric tons of threonine a year, or 500 million French francs. Up till now, threonine was barely competitive on the animal feed market because of production costs. By producing several hundreds of tons a year, Eurolysine (800 million francs in sales) was only beginning to open up the market. The European leader in lysine is now banking on annual production of 5,000 metric tons by 1995. "With a selling price nearly halved (35 francs a kilo instead of 60) in 5 years and higher margins than lysine's," points out Michel Rose, Orsan president.

The first step this year will be a relatively modest investment (100 million) that will make it possible to produce 2,500 metric tons by 1991. Following which, about 200 million will be made available for the acquisition of the new fermenters, dryers, and crystallizers needed to boost capacity. ""We are playing the flexibility card," comments Michel Rose.

In fact, haste would be unwarranted: the competitiveness of the lysine-threonine couple depends on the price of its competitor, soya, whose ups and downs are erratic, to say the least. "Even though farmers are prepared to pay a little extra for threonine," says Michel Rose. The explanation: amino acids, the precise dosage of which is easier to control than soya's, also, according to Eurolysine, reduce the protein excesses harmful to young pigs.

The next step for Eurolysine is to unlock new markets. Cattle feed offers particularly tempting prospects for amino acids—provided "coatings" can be developed to prevent their destruction during passage through the

stomachs of these ruminants. At the same time, Orsay researchers are working on a new additive of the lysine-threonine couple: triptophane.

In the immediate future, the collapse in soya prices may dampen Eurolysine's performance. "But in the long term, lysine promises good average profitibility," Michel Rose insists. In 1989, the steady strength of prices is what curbed the depreciation of Orsan's net profits (77 million francs, on sales of 1.9 billion), victimized by the fall in glutamate prices and losses in seeds. Orsan, which according to stockbrokers is highly sensitive to economic vagaries and offers little long-term visibility, must surely be wondering about timeliness of its Stock Exchange quotation.

Boxed Item—The Technological Process

Like lysine and methionine, threonine is an "essential" amino acid. Vital to life, it is not synthesized by animals and must therefore be added to their food ration.

Eurolysine manufactures threonine using biotechnological techniques. The raw material (from glucose) is converted into threonine during a score of successive reactions, each catalyzed (or accelerated) by a different enzyme.

These enzymes, or natural catalyzers, are manufactured by a bacteria, escherichia-Coli, that Orsan has altered to make more productive. To do that, genes responsible for enzyme manufacture were introduced into several bacteria at different chromosome sites.

Since threonine is a modified microorganism, Orsan was required to take all the necessary precautions to prevent its release into the environment and verify that it was not pathogenic.

COMPUTERS

ESPRIT Grant for Spirit Workstation Project

90WS0018E Paris ELECTRONIQUE ACTUALITES in French 30 Mar 90 p 12

[Text] With Kontron leading the way, six European companies and universities are taking up the challenge of countering American and Japanese supremacy in the workstation market. Esprit has granted them 30 million ecus (about 210 million French francs) to complete the project, with results expected in 5 years. Members of the "Spirit Worstation" consortium have selected Futurebus + as the system architecture. Only one French participant, the graphics specialist Caption, has entered the contest at the side of British Aerospace, Associated Computer Experts, Sussex and Tubingen Universities, and Westfield College.

First Results in '91

The six partners plan to engineer a station of unequalled power—1,000 MIPS—and as many MFLOPS within 5 years. Nonetheless, mid-term results are expected well before that, since a first product not based on Futurebus + will be brought out in 1991. The first Futurebus + products have been announced for 1992 or 1993. They will consist of multiprocessor systems with high-level graphics capabilities, particularly in 3D, and a processor for artificial intelligence. The whole thing will run on a Unix equipped with an object-oriented environment and AI languages. As you can see, Spirit participants are taking care to work with standard building blocks.

Each will bring his know-how to the project. The chief architect, Kontron, will be responsible for operations but will also have its own contribution to make. The Munich firm will engineer basic hardware including CPU cards and memory, system bus, inputs/outputs, and display controller. The company considers the project a strategic springboard for its stations programs, currently still based on a PC-AT architecture. So convinced of this is it that it recently partially reorganized its R&D department to make room for Spirit and allocated the project additional personnel and equipment.

The French firm Caption, based in Rennes, will be responsible for the development of the graphics system and will coordinate the university research in VLSI graphics. Here again, standard graphic interfaces will be used.

The company is already active in 3D graphic systems for medical use, but also in CAD, simulation, and real time. Spirit should allow it, it hopes, to expand its product line beyond graphics to image processing, knowledge bases, and high-level software.

The "Systems" division of British Aerospace will work on the artificial intelligence segment of the project, along the lines of what it is already proposing for military and spatial optronics. In particular, the firm will carry over its AI Declarative Language Machine system to the Spirit station.

The three other organizations are universities. Queen Mary College, which houses one of the biggest data-processing labs in Great Britain, will handle graphics software, programming technology in multiprocessor environments, and distributed operating systems. Sussex University will also be in charge of a graphics segment, with a marked emphasis on VLSI. Finally, the University of Tubingen will also work on graphics, an area in which it already has 15 years experience.

FRG Research in Computer-Aided Protein Design

90WS0008d Duesseldorf VDI NACHRICHTEN in German 23 Mar 90 p 29

[Article by Stefan Willeke]

[Text] Scientists of the Society for Biotechnology Research (Gesellschaft fuer Biotechnologische Forschung [GBF]) in Braunschweig are building new molecules on the screen and they are saving time and money.

This new area of research, called Computer Aided Protein Design (CAPD), is still in its infancy and the three-dimensional computer-aided combination of molecules is just now beginning to yield results.

Proteins are the key ingredients in the search for new substances in biotechnology. "Almost all processes in the human organism are controlled by proteins," says Prof. Dietmar Schomburg, head of the Molecular Structure Research Department at GBF. These tiny biocatalysators are compounds of high molecular weight which, in contrast to low-weight particles, are 100 times larger and more complex in make-up. The proteins consisting of spiral chains of 20 amino acids theoretically offer 10 330 square opportunities for exchanging the individual components, thus for creating new molecules. The entire universum, however, contains only an estimated 10 73 square variants of such molecules.

Against this background, it becomes apparent how much work the molecule modeling on the computer screen is saving us. To begin with, the experts have to "exclude as many variation probabilities as possible"—e.g., variations which determine the bent or stability of a molecule. Then, attempts get underway to concoct new combinations on the basis of pre-determined subareas within the molecule.

This new method replaces time-consuming test analyses in the laboratory. Until now, researchers had to rely on the "screening" procedure in the development of new antibiotics or fungicides. This method involved searching for certain properties of a newly created substance in the test tube, initially leaving its structures unknown. This resulted in an extremely time-consuming and tedious exploration process. The success rate for finding medically or technically workable substances was approximately 1:100,000.

The 50 researchers working with the CAPD method at the GBF in Braunschweig counter that result with a highest success rate of 50:50. "We are avoiding a lot of the mutation experiments," says Joachim Reichelt, a department physicist and researcher. According to Reichelt, it takes the microbiologists approximately one month to perform one specific mutation at one place on the molecule. With the aid of the computer, however, they are capable of performing three to four mutations in a process that takes no more than two weeks.

Even Computer Amateurs Can Handle the Software

To be sure, the GBF workstation, a hardware package worth 110,000 DM, only performs the important preliminary work to the ultimately conclusive experiments in the laboratory. And this is what reality looks like: the information specialists of the 500- employee center developed the appropriate software "Bragi," written in Fortan, the scientific-technical computer language that works fastest for this particular application. The program has been fed with all known molecule data. The relevant steps are relatively easy to execute—"suitable also for computer amateurs," as Reichelt commented.

The text program of the 40,000 DM software takes up a maximum of 16 mbyte storage while the external graphics program requires an additional 60 to 100 mbyte of storage.

The researchers sitting before the monitor enter the protein modeling program via a menu. They put on 3-D glasses without which they would be unable to recognize the places where the molecules are linked together. There are 4,000 colors to chose from to mark these spots: charges, types of acid chains, atom types, electrostatic potentials and hydrogen compounds can be recognized by their different colors. Then the modeling starts involving the entire molecule as well as small parts of it.

For instance, a researcher will experiment with the linkage angles of a 3-d protein on the monitor, then wait for a response only to discover that the intended new linkage does not work because the added amino acid has a repellent effect. "With good reciprocal action, we must determine the position which makes sense from an energy and geometric point of view," Reichelt explains. Consequently, the researchers must keep a watchful eye on the total structure of the molecule at all times for the outer shell must not be destroyed during the experiments. Electric charges and chemical reactions between two molecules to be combined determine success or failure of the monitor architect.

Against the background of the CAPD capabilities, Dietmar Schomburg is even speculating about building "custom-made" molecules—for a long time an uncharted dimension of genetic engineering. For example, in a project that drew widespread attention GBF, with the aid of Bragis, provided significant findings about the treatment of "septic shock," a disorder resulting from an accident or surgery leading to death in 30 percent of all cases.

When a person undergoes "septic shock," the white blood cells in the organism release large amounts of elastase, a natural protein, which in such high concentration attacks human body tissue. GBF was trying to synthesize an inhibiting agent to neutralize the protein's effects. The researchers used natural human proteins as their tools to create a blocking agent through specific computer-aided mutations. Ultimately, experiments in the laboratory confirmed the results of the molecule architects.

Joachim Reichelt knows that success lies in the details. "The microbiologists used to think that the best results are achieved by changing the charges of the molecule. However, the computer showed us in this case that you get further by changing the charges of an amino acid."

GBF does not operate in a vacuum. Ideas and direction for research were proffered by interested businesses which became actively involved in the Braunschweig Center a year ago. The joint "Center for Applied Protein Engineering" (Cape) was launched as an engine for research. Cape contributes 500,000 DM annually

helping cover part of GBF's costs. Cape includes representatives from the chemical industry (Bayer, Boehringer, Degussa/Asta Pharma, Goedecke, Hoechst and Kali-Chemie) and the computer industry (Hewlett-Packard, Commodore, Control-Data and GEI Computer Systems). Schomberg insists and emphasizes that research results are made available to these companies under the condition that they are made public and thus are accessible to other interested parties.

Supercomputer Slowed by Data Networks

90WS0008c Duesseldorf VDI NACHRICHTEN in German 9 Mar 90 p 21

[Article by Egon Schmidt]

To handle complicated tasks in the fields of physics, chemistry and engineering modern super computers with a processing capacity of millions of operations per second are often indispensable. Unfortunately, however, the data path capabilities required for the exchange of information among such machines is often lacking.

When the Leibnitz Computer Center of the Bavarian Academy of Sciences recently installed its new Cray Y-MP 4/432 Computer, one of the fastest super computers in the world, the bottleneck in the data paths became rather obvious. Prof. Heinz-Gerd Hegering, head of the Center, lamented that the exchange of data and programs between his machine and other fast computers in the country was inadequate as a result of the narrow lines of communication. In a comparison, Hegering contrasted that whereas broad freeways were required, the existing lines were more like very narrow bicycle paths. And these narrow paths were not capable of transmitting the amount of data desired.

At a press conference in Munich, Hegering directly confronted the Federal post office claiming that in the local network alone it charged excessive fees, e.g., for the use of broadband fiber optic lines with a capacity of transmitting approximately 10 mill. bits per second. Consequently, transmission of the same data over long distance networks along similar path widths—for instance, to the computer center in Erlangen—was virtually unaffordable. On the other hand, the post office had "idle capacities" according to the chairman of the Leibnitz Center's board of directors. Therefore, "we in the scientific community are fighting for the right to use these capacities on favorable conditions."

Asked by VDI-Nachrichten, Hegering added that the heads of the various scientific state and university centers in and outside Bavaria would be very grateful indeed if the post office gave them, on favorable conditions, circuits that were capable of transmitting approximately 140 mill. bit per second. "We are not even asking for 500 million bit performance," he said. Currently, the communication lines are capable of transmitting only approximately 64,000 bit per second between computers. Hegering also considers the 2 million bit lines which the post office is proposing to install "not enough."

The 34-million DM computer from the United States is a so-called vector computer ideally suited to process structured amounts of data, for instance, for computations performed in the analysis of complicated structures or currents. When this number cruncher was introduced—in a best case scenario and with "appropriately" posited tasks, the computer is capable of processing approximately 1 billion operations per second—the question promptly arose: could not a few thousand PCs perform these tasks with a much lower price tag attached?

Hegering responded to this pseudo question with an analogy which illustrates, perhaps better than a long treatise of computer architecture and programming principles, the fundamental difference between a super computer and a PC, even a fast one. "It is easy to swim in a pool of one thousand cubic feet—but it is not that easy to swim in a thousand pools of one cubic foot each." Indeed, not even in one million of such mini-pools.

However, research shows that there is an alternate way to put into reality the idea to distribute the performance of one super- capable and expensive vector computer on the shoulders of many small and inexpensive machines, i.e, by linking dozens, hundreds, and even thousands of small and inexpensive processors into mammoth parallel computing structures. The Munich-based Leibnitz Computer Center shows interest in such innovations only insofar as they consider it a subject worthy of further research.

As could be learned, there are currently no application programs which would turn these computers into useful tools in the hands of the average scientist who, in most cases, is not an information specialist.

In Munich, it was announced that one of these innovative parallel computers, the Suprenum, developed with government subsidies, is to be installed at the University of Erlangen in the near future. Hegering specified: "Of course, we are involved in the parallel computer activities. We want to be prepared as soon as these machines prove themselves useful in a working computer center such as ours."

Austria Research Center Develops VOTRICS Parallel Computer

90WS0008b Duesseldorf VDI NACHRICHTEN in German 16 Mar 90 p 18

[Article by Peter Kudlicza]

[Text] Since Austrian companies gained access to EC research programs in 1988, Alcatel-Elin, a research center, has made several internationally recognized contributions with its parallel computer, Votrics, and its expert system language, Pamela. The research center,

with an annual budget of 10 million DM, is a joint endeavor between the Alcatel concern and the state-run Elin.

Nothing in the world is perfect—not even a computer. It is just as impossible to vouch for fault-free intricate computer programs as it is to guarantee fail-safe components. "The computer has gone crazy," is an expression often heard when describing shortcomings in the software or loss of data. Nevertheless, in many areas of application, occasional defects are tolerated because the benefits of electronic data processing far outweigh potential damages.

The researchers at the Austrian center have solved this problem with a seemingly simple trick. Calling it "Votrics" (Voting Triple-Modular Computing System) they taught the system to be "fault-tolerant," maintaining that it is immune to defects and will continue to operate with no interruptions when a component becomes inoperable.

Under the motto "better be triple safe than sorry," three computers process three identical programs simultaneously. Votrics compares the data flow. In case one computer becomes defective producing aberrant (or no) results, the two remaining computers decide with their "two-thirds majority" where to go from there. The chances of two computers becoming defective at the same time and producing the same erroneous results, thus "overriding" the third and accurately working computer, are practically zero.

The key to the success of the Alcatel and Elin partnership—a multinational concern, on the one side, and a nationalized Austrian company, on the other side—appears to lie in international research cooperation. "Each contributes something and each gets everything," said Norbert Theuretzbacher, one of the center's two managers.

When in 1988, EC Esprit and Race programs for information technology and broadband communications became accessible to Austrian companies, the Vienna research center laid the foundation for its key role in Austria's participation in the European Community's research efforts. This entry proved difficult: usually, the EC shoulders half the entire project costs when the participating company is located in a member state. Austrian partners, however, have to seek funds from their national government. An additional difficulty lies in the fact that government-financed project participation approved by the EC does not automatically mean recognition by the EC. The non-EC partner is required to filea separate application and has to submit to another evaluation.

Approximately half of the entire research efforts go into international projects. For example, the parallel computer is part of InFACT, the Eureka project, coordinated by a British company which, in addition to the Vienna research center, has participants from Great Britain, France, and Italy. The project's objective is the development of a flexible assembly cell which will allow plants by the year 1992 to continue taking advantage of automation even when producing fewer units.

All partners benefit from their participation in Votrics. Alcatel Austria has made its entry into the telecommunications area, especially into high transfer efficiency, and into rail road safety technology. Elektra, an electronic signal box, has already been equipped with this device, the prototype of which became operational a few weeks ago at Neumarkt-Kallham station in Upper Austria on the railway line between Vienna and Passau. Elin plans to automate power and transformer plants with the help of this highly dependable system.

The principle of parallel computers is not a new one; it has been used in aviation and aerospace to improve computer reliability. However, those systems were specifically designed for their respective applications. In contrast, Votrics is run on commercially available computers and is adaptable to various requirements and client requests without any additional development efforts. In a discussion with the press, the system developers emphasized that given a statistical total failure of one every 1,000 years, currently there is nothing to match this system's reliability.

Also the performance of Pamela (Pattern Matching Expert System Language) is ranking high in the international arena. Pamela is said to be up to 35 times faster than comparable technologies in the United States.

Concurrent Development of Expert System and Hardware

As Votrics, Pamela operates independently of hardware and can be integrated into existing software. For the time being, Elin plans to utilize the electronic expert's benefits, reliably fast and accurate, in the area of large generators. With the help of the new programming language, a new analysis system for optimizing generator maintenance is being developed.

However, the best expert system is of no use if the computer does not cooperate and is slowed down to an unbearable snail's pace by the voluminous computing processes. In order to curtail response time and to speed up decision processes Alcatel-Elin developed the appropriate hardware for a fast Pamela: a parallel computer consisting of a commercially available and suitable AT computer with four double transputer elements. (Transputers are high- performance, one-chip computers). In its final form—it currently only exists in the form of a prototype—this system will be capable of processing 320 Mips (million instructions per second).

FRG-Developed, 32-bit RISC Chips Produced

90WS0008a Duesseldorf VDI NACHRICHTEN in German 23 Mar 90 p 21

[Article by Egon Schmidt]

[Text] It is called Hyperstone and it is the first 32-bit RISC chip developed by a German research team. It was rejected by the German Siemens Corporation approximately a year ago when the company favored the processor products made by the Mips Company in the United States. Now Hyperstone is being built anyway—but in the U.S. in accordance with the precise specification of its creator, Otto Mueller of Konstanz, the renowned computer pioneer and former Nixdorf computer architect.

The era of the micro chip which started approximately 15 years ago was almost exclusively dominated by American-made products; then a few years ago, the founder and temporary CEO of the CTM company—Computer Technik Mueller—in Konstanz launched the development of his own processor chip, a highly interesting product from a technical standpoint. Even though "Hyperstone" with its 32-bit RISC design and additional CISC features had been met with favorable approval by domestic and foreign experts years ago, Siemens, Mueller's dream partner for years, in the end shied away from signing a contract with Mueller following several promising meetings. This was a significant setback for Mueller; however, it did not put a stop to his efforts.

As was announced by the IMP Deutschland GmbH company in Munich at a press conference, Mueller's chip, employing the 1.2 fm process, will be manufactured by IMP's parent company in California. As IMP executive Reinhold Metzner explained, Mueller previously had optimized the design of his processor, adapted it to the process. He had thus created a chip which, its high performance notwithstanding, was extremely small and simple and, hence, could be produced cost-effectively and inexpensively.

It was learned that the latest design of Hyperstone will measure a mere 40 mm and, despite the fact that it only encompasses approximately 80,000 transistor functions, it will be able to perform a total of 25 VAX-Mips (millions of instructions per second based on the DEC-VAX computer). This is in contrast to other super processors with comparable power which consist of or even exceed a million transistors.

Most of Hyperstone's transistors (Mueller plans to market his Hyperstone to the huge but cost-conscious market of cushioned control of printers, telecommunication systems and similar applications) are located in the register stack and in the on- chip command buffer memories. It is above all these two compact components which, in addition to other details, contribute to the high speed Mueller expects to achieve. The control logic, on the other hand, will have comparatively fewer transistors.

Knowledgeable sources revealed that Hyperstone's key technologies are based on the exclusive control logic for the register stack and buffer memories either patented already or for which patent applications are pending. Since it is possible to program this chip much like one of the well-known Motorola 60000 chips it does not appear to be difficult to win over computer engineers to the benefits of the new chip.

With a view to the distant future it is interesting to note that it would be feasible to establish a simple parallel connection between two Hyperstone units and, by combining processor chips, to produce 80 Mips computing capacity. Conceivably even four chips could be combined which then, in a high-speed gallium arsenide procedure, would be capable of penetrating areas of several hundred Mips.

Mueller, who is rumored to have close contacts with a well-known U.S. semiconductor firm in light of a prospective mass production of his creation, will receive his first prototypes from IMP by the end of May or beginning of June, Metzner promised. Metzner also used this opportunity to provide information about his company.

Half of IMP-Deutschland GmbH is owned by a British parent company 38 percent of which, in turn, owned by IMP in San Jose, California. The other half—considering itself the electronics and services center—belongs to MBB/SCE of Daimler Benz in Nabern close to Stuttgart, according to Roland Pudelko, head of MBB/SCE and manager of IMP-Deutschland.

IMP is involved in the development and manufacture of application-specific integrated circuits (ASICs) in analogue and analogue-digital Cmos-technology. Metzner emphasized: "First, we conduct a feasibility study and only then do we sign a contract based on the milestone principle." This means that a client pays for each individual service rendered by IMP only when he can identify with the development results of his circuit following its conversion into ASIC.

The ASICs, for which there are approximately 30 different Cmos production processes, are developed at the IMP/SCE Center with its 50 engineers in Kirchheim/Teck. MBB/SCE itself currently has about 250 employees, while the parent company in San Jose which was founded in 1981 and has a turnover of approximately 150 million DM currently employs about 500 people.

According to Pudelko, the MBB/SCE Center is equipped with 15 sun work stations as well as more than 20 PCs connected to a network from where IMB and DEC computers can be accessed. There is more than 100 Mips of computing power, more than 4 GByte disk memory capacity available and the company is capable of making available to its clients numerous development tools, e.g., chip design programs.

However, Mueller did not utilize those tools to create his spectacular "Teutonic" Hyperstone, but developed it at his own facility in Konstanz. Hence, he simply handed over to IMP a file detailing the instructions for building the 32-bit chip.

Italy: Olivetti Voice Computer Experiment Described

90MI0177 Milan ITALIA OGGI in Italian 17-18 Mar 90 p 44

[Article by Gabriella Cattaneo: "This Computer Talks With Doctors and Writes Reports"]

[Text] Many experts maintain that vocal communication with computers will be quite normal in the 1990's. One of the first experiments of this kind in the world, and the first in Italy, has been in progress for approximately two weeks at the histopathological laboratory of the Regina Margherita Children's Hospital in Turin. The talking and listening system is an Olivetti M280 personal computer that was partly tailored for this purpose by the Turin-based language processing research laboratory, directed by V. Vittorelli. How does it work? While the pathologist examines a sample under the microscope, the machine asks some questions about it. The physician answers with a word or a short sequence of words, which the machine repeats out loud to confirm that it understands correctly. This continues until a typical medical report is completed.

Vittorelli explained: "The advantages are that the report is ready and automatically printed as soon as the analysis is over. This avoids time delays and possible data input errors. The method also ensures uniform and complete reports."

The logical structure of the dialogue and the expressions used in the texts were predefined by Dr. M. Forni and Professor G.C. Fiorucci (head of the department that is carrying out the experiment), using Olivetti software tools, which may be easily modified to suit similar cases. For the time being, the system seems to be performing successfully, but conclusions will be drawn after a few months. "After which it is up to the company to decide whether and how to launch the product on the market," Vittorelli added.

The use of voice in computer dialogue is currently restricted to a number of specific, well-defined areas, such as meaning and language structure. The problem does not lie in making the computer talk— vocal synthesis is a relatively well-developed technology—but in making the computer listen to and understand what is being said.

The Olivetti research center, for example, has developed a voice recognition prototype that now has a vocabulary of 30,000-40,000 words. This prototype can learn to understand a person in 10 minutes by listening to a sample of 30-340 words. These systems will eventually be used for home banking by telephone (checking account holders will be able to obtain information by telephone by identifying themselves). Olivetti is the prime contractor for an ESPRIT [European Strategic Program for R&D in Information Technologies] research project called Polyglot, which is now extending this technology to other EEC languages.

"We are still far from 'universal' automatic, text-to-text translation systems. Those that do exist are restricted to a limited number of fields," Vittorelli explained. Some companies such as Fiat already use automatic translation systems for product documentation manuals. Olivetti has decided to wait because these translations still present considerable shortcomings. Some interesting tools already exist. The Turin laboratory, for instance, has presented a morphological dictionary of the Italian language (containing words and verbs, even in their conjugated forms) with two million expressions, which is readily accessible through an ordinary personal computer. It is capable of explaining that "leggere" is the infinitive of a verb as well as a plural feminine adjective, and that the word "volta" has as many as nine different grammatical interpretations.

The dictionary was developed for the direct dictation of tests to a machine or for vocal synthesis based on a free text, but will also act as a translating or teaching aid.

DEFENSE INDUSTRIES

Aerospatiale, MBB Agree on Helicopter Production

90WS0017a Paris LE MONDE in French 7 Apr 90 p 33

[Article by Jacques Isnard: "A Marriage of Convenience"; first three paragraphs are LE MONDE introduction]

[Text] The French group Aerospatiale and the Germany company Messerschmitt-Bolkow (MBB), a subsidiary of Daimler-Benz, concluded an agreement protocol Friday, 6 April providing for the immediate "harmonization" of their helicopter-production divisions. The latter will be followed by the creation of a holding company, dubbed Eurocopter, before the end of the year. It is an important weapons agreement, at a time when cooperation between the two countries appeared stalled.

The holding company, 60-percent controlled by Aerospatiale and 40-percent by MBB until the two companies' respective contributions are fully assessed, will be headquartered in Paris and will in turn have full control of both of the divisions involved. Two Frenchmen will preside over the Eurocopter holding company's board of trustees and directorate.

Though each of the two divisions is retaining its national identity, the new organization, which has already declared itself open to participation from other European manufacturers, should cover about 30 percent of the world market and represent annual sales of over 10 billion French francs.

Aerospatiale president and general director Mr Henri Martre has invested a good deal of himself in this European adventure. To hear him tell it, the "non-merger organizational rapprochement" or "partnership" with MBB represented by the Eurocopter holding project is the way for Europe to stand up to the United States in

this industry. It is an industry in which, by combining all its strengths, Europe is not, after all, poorly positioned.

It is a marriage of convenience, but one which could become a "menage a trois", or even four, if the Italian company Agusta and the British firm Westland, who have already been approached, opt to link up with the Franco-German couple.

Next to Sikorsky (12,400 salaried workers), which dominates its American rivals Bell (9,000), McDonnell (9,000), and Boeing (6,800), the Franco-German duo is far from laughable. Aerospatiale's helicopter division, with its 7,150 salaried workers and its 6,650 million in sales in 1989, three-quarters of them export sales, has already succeeded these last few years in capturing nearly a third of the world market (excluding the USSR and the American military market). MBB's helicopter division, with its 5,000 employees and its 980 million deutschemarks in 1989 (the equivalent of 3,235 million French francs) is a hefty ally under the circumstances.

Thus, when the two divisions are officially brought together next year, with the blessing of the political and administrative authorities which oversee them, the Eurocopter holding company will try to combine the industrial-financial resources of the two countries to jointly carry out programs written into the national budgets of each partner.

Two Major Programs

For this Franco-German marriage presupposes harmonization of the two divisions' long-term research, a joint trade policy, and an identical product catalog. Essentially two programs are involved for now: Tiger (a combat helicopter for both the French and German armies, numbering 427) and NH-90 (a maneuvers helicopter designed in cooperation with the Netherlands and Italy, numbering 600). The first program seems definitely set. The second still requires a few touch-ups (notably, a "green light" from Italy) but French and German manufacturers are ready to go ahead without waiting.

Aerospatiale and MBB do not want to stop at those two projects, which are primarily military. The two companies also intend to establish, for the future, a complete line of civilian helicopters, such as the P120 (with the Chinese and Singapore) or a light MBB helicopter (with India).

"Europe," explains Mr Martre, "is an all-around competitor of the United States, where the technological and financial base is guaranteed by the Pentagon. The Franco-German association is open to other European partners, the Italian firm Agusta of course, but also Westland, whom we have suggested design a version of Tiger for the English army."

For the rest, helicopters are not the only field of action for this new European adventure. In the military sphere, the ANS (anti-ship supersonic missile), AC3G (new-generation anti-tank missile) and Eurosam (anti-aircraft missile) programs are trying to bring together primarily France, Federal Germany, the United Kingdom, and Italy on cooperative efforts for which Aerospatiale's and MBB's other specialized divisions are already or about to come together.

Consolidating this European weapons market has become Mr Martre's obsession. It is a market he estimates at about 350 billion francs a year, compared to a world market on the order of 2,100 billion francs. It is half the American market. But it is primarily a market of totally unbalanced exchanges, across the Atlantic, in which Europe (seeking high technology) buys eight times more military equipment from the United States than the U.S. buys from it.

"When European industry suffers from such a handicap at the starting line, especially in combat aviation and missiles where the United States dominates," explains the Aerospatiale CEO, "should we risk opening the European market if there is no reciprocity? American penetration [of the market] must be countered. If European industry is unable to impose a common policy on itself, it will go down in flames for having tried to play by the rules of naive liberalism."

Initially, the only possible route is to shore up the French-French "poles of excellence", to use the minister of defense's own words, in order to subsequently build alliances with Europeans willing to take up the challenge.

Retrenching in Procurement Strategies Seen

90WS0017B Paris L'USINE NOUVELLE in French 29 Mar 90 pp 91-92

[Article by Daniel Coue: "Defense and Aeronautics Rationalize Their Purchases"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Fewer suppliers but more loyalty to them and a sharing of risks: Thomson and Matra Defense are changing their purchasing policies to improve competitiveness.

Until now quite reticent, the big orderers in electronics, aeronautics, and weapons are going to reform their purchasing policies, as automakers did before them.

Even Thomson has jumped on the bandwagon. For the group, so often accused by its suppliers of fickleness, it is a total about-face in attitude!

The Pact (which stands for competitive purchasing at Thomson) plan, which has just gone into effect, essentially applies to the Thomson-CSF subsidiary and Sextant Avionics, a joint-venture of Thomson-CSF and Aerospatiale. But it will inevitably influence the group as a whole. "Our goal is competitiveness," explains Pierre Gosselin, manufacturing director at Thomson-CSF. "Purchasing is no longer the simple support activity it

once was. It has become an authentic strategic function...". Purchasing represents 50 percent of sales, or 15 billion francs.

To the question of why this was not thought of earlier, Pierre Gosselin replies: "We had to restructure on the inside before attacking the rest." In fact, hampered by overstaffing and a surplus of factories, the group had little chance of applying consistent principles to the choice between doing and having done. The housecleaning is now over. Factories like Laval or Saint-Pierre-Montlimart have been relinquished. "To achieve greater efficiency, we have shifted our focus to our strong points," remarks Pierre Gosselin. "Industrially, we were involved in 20 different occupations. Now we will be involved in only two: defense electronics and consumer electronics." And then comes purchasing....

But first of all you have got to know how to buy. That, in reality, is Pact's first goal. Drafted with the help of Peat Marwick Consultants, Pact aims to develop communication between purchasing and other departments (marketing, research, methods...). It also plans to internationalize purchases in order to gain access to the "best sources."

Guideline agreements will be signed with suppliers for "sensitive purchases". Thomson will guarantee loyalty to the supplier, communicate its forecasts, and predict future technological changes. In return, the group will require its partners to "play the game": zero defects and zero delays will be mandatory. But in addition, productivity gains will have to be regular. The social climate, management, and staying power of the company will be monitored, audits in hand. Though the Thomson case is the most recent and perhaps the most unexpected, it is not unique. Others, such as ESD, Telemecanique, IBM France and, just recently, Aerospatiale, Bull, and Matra Defense have taken the same road. "Our customers are not as flush as before. And international competition is heating up," comments Gerard Clinquart, purchasing and supply director for Matra Defense. "We have no choice but to get in tune. It concerns us, and concerns our suppliers just as much. We must cooperate better and share the risks and profits when there are any...."

With this in mind, "partnership" contracts have been developed. They set the rules of the game, general conditions for joint endeavors, and stock-option and penalty clauses. Added to this are the guideline contracts, which mention firm-order programs for 6 months, estimated ones for a year and a half. "Competition remains open. But in fact, barring errors along the way, these contracts commit us for the life of each product, or 5 to 20 years, depending!", points out Robert Chauprade, Matra Defense director of operations. Naturally this encourages one to be demanding and to closely monitor changes in partners. Above all, suppliers are asked to be capable of becoming involved as early as the preliminary-study stage in development costs and manufacturing-run prices, in order to produce figures as exact as possible and compare solutions. It goes without saying that such close collaboration will be reserved to time-tested firms.

Adoption of partnership in the automobile industry brought about a nearly four-fold cutback in the number of direct suppliers. For now, both Matra and Thomson refuse to put numbers on their targets. Matra Defense (6 billion in sales), with its 2,000 principal suppliers, seems to be in the same hypothetical situation as the automobile industry. But at Thomson-CSF (15,000 suppliers), the retrenchment should be much greater. Some buyers are even said to have mentioned a ten-fold slash!

That does not mean that the "flunk-outs" will no longer work for the group. Some of them will become subcontractors for first-line suppliers—an unenviable situation! Besides, the orderers—notably Aerospatiale—are thinking of limiting the number of sub-contracting levels for each order (there is talk of two at most). Adjustments are likely to be rocky....

FACTORY AUTOMATION, ROBOTICS

French Lab Creating Third Generation Robots

[Article by Bernadette Lacaze: "Mobile Robots Beefed Up with Artificial Intelligence"; first paragraph is L'USINE NOUVELLE/TECHNOLOGIES introduction]

[Text] They walk...and on top of that, they think! Autonomous mobile robots must act in complex environments, from subways to the planet Mars. Georges Giralt, head of the Laas robotics and artificial intelligence group, unveils the world projects which are setting the stage for third-generation robotics.

The future housekeeping robot for the Paris subway has made some very attention-getting forays lately onto the platforms of the Les Halles station. Set loose amid travellers, it performs its work without bumping into obstacles, including subway users, goes down stairs, and stops at the edge of the platform...without operator control. The machine, slated for mass production this year, is only one of the many concrete applications of mobile robotics. The latter has paved the way for robots outside the manufacturing field, ranging from service robots, to—perhaps—domestic robots, to robots that perform tasks on other planets.

These applications are the product of research on mobile robots that began at the end of the sixties. Two American projects, Shakey at SRI (Stanford Research Institute) and Hexapod at Ohio State University, are considered the pioneers in the field. They represent two approaches: development of artificial intelligence in Shakey's case, and all-terrain locomotion with pod-feet systems for Hexapod. The object of the Shakey project was "to study the process of real-time behavior in a robot system

interacting with a complex environment." It was the beginning of what was later dubbed third-generation robotics.

Robotics was born at the start of the sixties to assist in performing tasks in environments—nuclear, undersea—hostile to man. At that time, the machines were directly controlled by a human operator. The development and different complexities of robots has led to a somewhat rough classification system. Besides robot arms, either manual (controlled or remote-controlled by man) or automatic (not controlled by an operator, but programmed for each precise task), there are programmable robots capable of grasping the task to be accomplished through learning or symbolic language, and robots equipped with multisensory sensors that react to changes in the environment. The latter, called third generation, have capacities for making intelligent connections between the perceived work environment and the actions to be taken.

Thousands of researchers are currently working on third-generation robot projects. The Automation and Systems Analysis Laboratory (Laas) in Toulouse is in perpetual motion. Its Hilare (Integration of Heuristics into Open-Ended Robot Software and Automatisms) project began in 1977. It is the oldest of the still-running projects in the world. Its research themes are those needed to master autonomy in machines that must move about in a physically encumbered and randomly changing environment. Methods, techniques, and tools to assure this autonomous mobility must be devised. These requirements entail six broad research areas: automated locomotion, merging of multiple sensory inputs, geometric and spatial thinking, generation of action plans, real-time decision-making capabilities, and learning.

Another robot christened Hilare Junior, which features more sophisticated equipment and incorporates innovations such as stereovision, was added to the Hilare experimental base in 1988. The laboratory is awaiting a third robot: Hilare II. With powers of locomotion that also allow it to move about outside and data-processing power about 10 times greater than its predecessors, it is intended to support research studies for the next 10 years.

The fact of having several mobile robots, each with comparable capabilities (perception of the environment and decision-making autonomy), will considerably expand Laas's field of demonstration, for it is valuable to conduct similar software-validation tests in different places. On another front, robot chases have already been performed, in which the second robot does not necessarily encounter the same obstacles as the first. These tests are a preliminary step in setting up studies where many robots interact with one another. They are a fair representation, for instance, of a factory floor where several systems must operate. Taking into account machine-machine and machine-environment interactions raises new problems of environmental perception and interactive processes. Other research themes are on the horizon....

Robots Developed for Steelworks Construction

90WS0019A Paris L'USINE NOUVELLE in French 15 Mar 90 p 95

[Article by Didier Gout: "Robots Chase Bricklayers From the Steel Plants"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Piloted by Arbed, companies are developing a bricklaying robot for the steel industry designed to eliminate the arduous work of masons. The program will be given the Eureka label.

For lack of masons, the steel industry is calling on robots. In its research center in Esch, the Luxemburg group Arbed is inaugurating—a first—a bricklaying robot for steel plant converters which automates a manual task "so arduous that bricklayers are harder and harder to find," according to Jean Liesch, the process head for Arbed Research.

Twenty masons are called in every 15 days! Their task? To reline the inside of converters (where the molten mass is converted to steel) with heat-resistant bricks. The masons lay 15,000 bricks weighing 30 kilos each in the crucible.

Why hasn't this job been automated? "The integration engineers are cold-shouldering the steel industry, where the number of machines to be sold is limited," believes Andre Kremer of the Paul Wurth company, chief of the masonry robot project.

This Arbed engineering subsidiary (670 people) has therefore attacked the problem of robotizing bricklaying, in collaboration with Hydraudyn (the Dutch subsidiary of the German company Rexroth), Delft University, Scoril in Metz, and Inria (National Institute for Research on Data Processing and Automation). The project is backed by the Community, which gave it Eureka notification at the end of 1989.

Research, which began in 1986, will result in the first machine being put into operation in 1991. It will pivot around a mobile, tractor-drawn car which will hoist from underneath and inside the convertor a platform equipped with a robot arm. The machine will be aided by two other robots: one for first cleaning up the remains of the used heat-resisting brick with a mechanical pick, the other for unloading the bricks from the pallet.

The masonry is the touchiest part of [converter] architecture, as demonstrated by the technical challenges of the first installation (using Kuka and Asea robot components), which is being tested. It is the overall intelligence of the bricklayer that the robot must acquire. It evaluates not only the roughness of the brick (through sensors) in order to abrade it, smooth it, and very precisely place it,

but also selects the right brick from different-sized ones (aided by vision) to lay a perfect circle. It also takes into account the dents and warps in the sheath lining the metal crucible. The robot is allowed 15 seconds between unloading and placement of the new brick.

Boosting masonry productivity is another motive for the installation. The weight of the bricks will be doubled to acccelerate speed of placement. "To bring down the working time of each intervention from 3 to 2 days (an annual gain of 24 days)," says Jean Liesch. Is this challenge about to be met? Arbed officials say it is. Twenty-five people are working on the project in Europe and eight patents have already been taken out. And though the Japanese have already filed 20, the Europeans intend to take the lead.

Peugeot, Citroen Apply Just-In-Time Principles

90WS0019C Paris L'USINE NOUVELLE in French 22 Mar 90 pp 68-69

[Article by Pierre Laperrousaz: "The Realistic Approaches of Just-In-Time"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Application of just-in-time principles is not necessarily synonymous with heavy investment. It is more a matter of correcting and stabilizing flows.

Have the zealots of zero stock gone too far? Aren't the just-in-time purists, who consider the total elimination of breakdown risks and other defects, reduction in batch size, and one-minute tool changes preconditions for applying Kanban, hampering the spread of this technique in industry? Isn't the quest for maximum flexibility sometimes too costly?

Manufacturers are asking themselves these questions after years of conducting their experiments and years of digesting the lessons of Taichi Ohno, former Toyota vice-president and inventor of just-in-time principles, Shegeo Shingo, advocate of rapid tool changes, and other Japanese and American gurus.

There is no need to invest heavily. "You can apply Kanban in your old shop starting tomorrow morning," maintains Yves Milles. The head of "competitiveness and just-in-time" programs in the production management division of Peugeot Automobiles is not exaggerating by much. The inventor of a just-in-time-principles training method (a company game), he has just used it to teach the management staff of a Sochaux metal-stamping shop. "Three months later, the shop ran using Kanban methods," he says. No changes were made in production schedules or batch sizes. There was no attempt to pare the time spent changing tools. But flow between machines is now synchronized according to Kanban principles and is completely independent of the centralized management system. Result: the shop, which sometimes had to work Saturday mornings to complete its contracts, now manages to have Friday afternoons free to do preventive maintenance. And stocks have been chopped 15 to 20 percent. "What's essential is to correct and stabilize flows to get a total picture of the shop's functioning, whatever its initial state," explains Yves Milles.

From Dreams to Technical Realities

A rather unorthodox course, which he opted to apply first to the group's Madrid factory. The problem consisted of using Kanban principles to connect a foundry, a machining transfer-tool, and the assembly line of the Talbot-designed engines. The breakdown rate of the machining tool was 40 percent—theoretically incompatible with just-in-time principles. "Well, investing in equipment was out of the question." So the shop made do, by calculating in-hand stock as precisely as possible to absorb the effects of unexpected events. This enabled the factory to cut by a factor of more than 10 the time it took for parts to file by and to decrease its stock.

The persistence of stock in fact reflects the imperfections of the production system. Because of this, it is a good indicator of the improvements that need to be made. However, zero stock is not always a realistic objective. "It's a dream that has seduced financiers, but that cannot always withstand certain technical realities," confides Claude Dudouet, director of the logistics project at PSA. The group intends to completely reorganize management of its internal flows before the end of 1991 (only 20 percent so far) and of its supplier flows between now and 1994 (5 percent last year). They hope by doing so to lower delivery time of vehicles to dealers from 30 calendar days to 16 or 18 days, and to give dealers the greatest possible choice in models ordered.

A Question of Balance

At the same time, industrial stocks should drop by 20 or 30 percent. But with important adjustments, depending on the part. For some parts, such as timing-gear housing, zero stock is possible, for they can be machined one by one from an identical roughly-manufactured piece and according to the type of engine being manufactured. "But forming of parts one by one, though possible in assembly, welding, and machining, is only justified for wrought and expensive components. It's not profitable, and is even technically impossible, for the others. That's the case with forged, embossed, or pressure-injected components," explains Claude Dudouet.

Stock levels are thus a matter achieving a balance between technical and cost constraints, and it is up to the "maker" to decide. That is what Epeda-Bertrand Faure, which delivers seats to Citroen Rennes, did in its Redon factory. Until then, the company's factories had always worked in fully synchronous flow with their customers, beginning assembly of seats at the exact moment the car rolled onto the paint floor at the automaker's. But Epeda-Bertrand Faure adopted another policy at Redon: seats, manufactured with a half-day time lag, are stocked in an automated 1,400-place warehouse which cost 8 million French francs. The advantage: it allows the

company to work on 7 or 8 seats "in bursts", enabling the worker to be more efficient than when he works piece by piece. A matter of getting the proportions—flexibility and efficiency—right....

SNECMA Using CIM in Engine Repair Facility

90WS0019D Paris L'USINE NOUVELLE/ TECHNOLOGIES in French Mar 90 p 16

[Article by Michel Vilnat: "CIM-Optimized Repair"; first paragraph is L'USINE NOUVELLE/ TECHNOLOGIES introduction]

[Text] At the Sochata repair plant, computers organize everything—estimates, supplying of parts, and more—from the moment the jet engines arrive.

The CIM (Computer Integrated Manufacturing) concept was formerly reserved to mass-production plants. Now the repair sector is in on the fun. Sochata, a SNECMA subsidiary, has just inaugurated a brand new facility in Saint-Quentin-en-Yvelines for repairing airplane engines in which computers are ubiquitous.

The facility already has 150 consoles that communicate with each other in a network; there will be 200 between now and the end of the year. Two computers, one of which is a Bull DPS 7040, supervise the whole operation, working in parallel with computers of the other Sochata factory, in Chatellerault, if needed. A specific program, christened Booster, was developed to manage all the tasks. The inspectors use it as soon as the engines arrive in the inspection shop, when they enter, via the terminals, the list of repairs to be made and the reference numbers of the parts. The computer immediately figures the cost of the different operations and chooses between repair and replacement of the defective components. This will optimize estimates. If a part is needed, the warehouse, which automatically manages 2,800 stock boxes, is informed the very next minute.

Besides being fast, this set-up, which is linked to the GPAO (computer-assisted production management), eliminates all paperwork. With just this in mind, Sochata is preparing, together with CFM International, to do away with the some 3.6 million pages that make up the technical documentation of CFM 56 engines. They will make way for six numerical optical disks. The latter will be able to be consulted via screens placed throughout the different shop floors, which also make extensive use of data-processing: The washing and pickling line, for example, is operated by a loading robot that automatically lifts the parts from box to box.

This ultimate in computerization will substantially reduce the amount of time engines will be out of service.

MICROELECTRONICS

France: GRESSI Submicron Silicon Chip Project

90WS0018C Paris ELECTRONIQUE ACTUALITES in French 9 Mar 90 p 16

[Article by D. Girault: "IC: Creation of an EIG Combining the CEA and CNET"]

[Text] The Atomic Energy Commission (CEA) and the National Telecommunications Studies Center (CNET) have signed a collaboration agreement to create an economic interest group called Gressi (Grenoble Submicron Silicon). With a budget of about 90 million French francs and a staff of 90 equally divided between Leti's Grenoble Lab and CNET's Norbert-Segard Center, Gressi will prevent "duplication of efforts" by the two Grenoble laboratories on basic research concerning silicon integrated circuit technology. The director of Gressi has not yet been named, but it is known he will belong to Leti (Laboratory for Electronics and Data-Processing Technology). The assistant director will come from the CNS (Norbert-Segard Center).

"Upstream" Research

Gressi's research will be focused "upstream" of studies that take into account the precise specifications of manufacturers. These studies, already jointly underway, deal with the development of 0.25 and 0.35 μm CMOS technologies. They fall into the BLR (Basic and Long-Term Research) cataegory of the Jessi program. Industrial applications are slated to begin in 1995.

The BLR program is open to all proposals. Leti, the CNS, and the CNRS (National Center for Scientific Research) had already made proposals within the program, dealing, among other things, with the engineering of steps leading up to the development of a 0.25 μm technology. The CNSR [expansion unknown] is involved in the project, since it is a member of the Silicon Integrated Circuits Group (GCIS) created in 1979, as are the CEA and the CNET. (The CNET is only an associate member, but this makes no practical difference). The purpose of the GCIS is to orient basic research: The organization determines the desirable orientations, likely to have industrial applications. The creation of Gressi should facilitate practical cooperation between Leti and the CNET on the one side, and the CNRS and universities on the other: rationalization of the requests issued by Gressi should help the research partners.

In contrast, creation of this EIG should in now way hinder the two parties from pursuing current programs. And if one of the partners expresses an interest in the findings of the other in a particular field, he will have access to them for a fee....

The construction of "Grenoble 92" is thus continuing apace. This agreement was missing from the table (See ELECTRONIQUES ACTUALITES 7 Apr 1989). Leti and SGS-Thomson have been parties to an agreement to

develop bipolar product lines—CMOS and mixed bipolar/CMOS—since March of 1988. It is a 6-year agreement financed by SGS-Thomson, the CEA and the Ministry of Industry. In practice, it anticipates "market outlets for a 0.5 μm CMOS product line and EPROM 4 and 16 Mbit products." The program is the work of 200 people from Leti and SGS-Thomson (working at the Leti site) and has an annual budget of 70 million French francs.

The CNET and SGS-Thomson also signed an accord last December, as part of the Jessi program. The agreement provides for the two organizations to jointly set up and operate a research and development center working on submicronic silicon technologies, within the format of an economic interest group managed equally by the two parties. Total investment is expected to be 750 million French francs, for an initial staff of 150 to 200 people to be drawn from both the CNET and SGS-Thomson.

Italy: Bioelectronics Research Program Described

90MI0181 Turin MEDIA DUEMILA in Italian Mar 90 pp 93-97

[Article by Riccardo Panigada: "A Project To Compete with Mother Nature"]

[Text] Some proteins are capable of preserving, transferring, and modulating information. Their activity depends on their structure (steric molecular conformation) or sometimes on the different structures that they are able to form. The following terms are used to define the "shapes" of proteins: primary, secondary, tertiary, quarternary, and quinary structures. Each protein is highly specialized for a given function and can perform its task only if it has the proper structure.

Until now it seemed that only Mother Nature was able to set up such a sophisticated information system. In fact, depending on each protein's primary structure (amino acid sequence) electromagnetic interactions that produce the various superior arrangements are developed inside a molecule.

Recently, however, the Ministry of University and Research set out to clone such a perfect procedure to enable its transfer from biological to electronic hardware. Such an ambitious program (National Bioelectronics Program) calls for extremely high-level statistical and biophysical research and requires the establishment of interdisciplinary groups of highly interactive researchers. Industry must also be actively involved in this research program.

Claudio Nicolini, vice president of the national bioelectronics committee, is the main promoter of this innovative project. A decidedly revolutionary idea underlies the program: Exploiting the self-organizing capabilities of biological structures as well as the transmission modes of protein signals to develop biochips that can self-assemble by using an initial instruction code, exactly as miraculously happens in nature with cellular physiology.

The long-term program is even more challenging: Nicolini talks about "improving" the properties of natural proteins. In other words, the program appears to be in competition with Mother Nature as it sets out to improve the biological materials that have been obtained phylogenetically over hundreds of thousands of years. "Therefore," Claudio Nicolini observed, "it was necessary on the one hand to bring together the most qualified international researchers, and on the other, to motivate the major (pharmacological, chemical, and electronics) companies. A census based on bibliometric indicators located 200-300 people in Italy working at the international level. Farmitalia, SGS-Thomson, and Montedison have indicated an interest in the program, in a climate that will soon be reminiscent of the atmosphere of frantic cooperation in which one works when major objectives are at stake."

It is rumored that Prince Sansevero carried out "metalization" experiments on the human body some 200 years ago. Today, we are likely to witness the birth of a biological-electronic hybrid that will exploit the most interesting and promising phenomena currently being investigated in physics, chemistry, and biology. These include the tunnel effect, electron transfer, and the modification of the steric arrangement of signal transmitting molecules.

An eight-year ministerial research project had never existed before. Neural chips and sensors that are 10,000 times smaller than VLSI [very large-scale integration] networks will be produced during the first three-year stage. Nicolini is determined: "If this does not work, I will not hesitate to abort the project as I did not hesitate to launch it." He added: "Our goals are very ambitious. We want to understand the relationship between the primary and the tertiary structure of proteins (space conformation) by using 'bottom-to-top' procedures to characterize the three-dimensional structure of molecules (through nuclear magnetic resonance and X-ray crystallography) from a biophysical standpoint and by using computer-modelling techniques. Only with an understanding of these relationships can we artificially modify molecular properties in a profitable manner."

Claudio Nicolini also believes that Italy should not have abandoned its hardware studies by using technologies (from silicon to gallium arsenide) that are essential to the telecommunications industry: "Italy seems to be a huge softer house [as published], with few successful technological centers (citing as an example SGS-Thomson's research laboratory, a company 'abandoned' by the Italian academic world while Olivetti bought a foreign mainframe" [quotation marks as published]. Nicolini hopes that two members of the national committee that he chairs, Federico Capasso, head of Bell Laboratories, and Federico Faggin, president of Sinaptics, will return from the United States) [close parenthesis as published]. "Above all," Nicolini continued, it is necessary as of today to start thinking about a chip with CHEM-FET architecture (chemical field-effect transistor). Many

people and companies unwilling to change their approach may find themselves in difficulties."

Consequently, at the dawn of the third millenium, shifting the focus from mechanical (or mechanical-electronic) products to biostructures could lead to a modification in the methods that industry has adopted since the 19th century, when organizational structures were first established in the factories. Vincenzo Tagliasco presented a paper on this trend that covers the design of biological structures from proteins to so-called molecular (or biological) computers at a bioengineering course held in Bressanone last September. After describing the Japanese Human Frontier Science Program, the European BRIDGE [Biotechnology Research for Innovation, Development, and Growth in Europe] program, and OECD contributions to the area of biotechnology, Tagliasco questioned whether we are witnessing a turning point in the industrial sector, which, despite the periodic introduction of new technologies, has been primarily manufacture- oriented, or better, mechanical manufacture-oriented since the 19th century.

Almost 100 billion lire will be earmarked for the first three-year stage of the national bioelectronics program, 10.2 billion of which is intended for the cultural and professional training of researchers and research technicians. CIPI [Interministerial Committee for the Coordination of Industrial Policy] has already approved the overall funding suggested by Nicolini's commission (230 billion lire) for the following five-year period. If the program covers basic research activities with an unpredictable outcome and therefore without certainty of industrial applications, the long-term goal of the proposed research on proteins is also their long-term extensive use in bioelectronics. In the near future this will involve the specific area of protein engineering (biotechnologies) and the production of VLSI neuronal chips and sensors with immediate economic as well as scientific interest and with a considerable impact on all industrial areas.

The two research stages with different durations are not only designed to allow for the monitoring of the work after a 36-month period but also to reduce the risks, or better, to make it possible to correct the program while in progress. The activities to be carried out during the second five-year stage will heavily depend on the research findings of the first three years.

Electronic, Neural, and Submicron Areas

Theme 1 Silicon neural circuits and architectures for sensors and learning systems.

The Italian company SGS-Thomson is already carrying out research in this area. Its VLSI research laboratory in Agrate is one of its most prestigious advanced centers. The vice-president, Enrico Villa, who is responsible for contacts with institutes, firmly believes in the potential of neural electronics. In view of its future integration with traditional electronics, neural electronics offers a solution to problems calling for analog computing procedures (image, sound pattern, echo, movement, recognition, etc.)

Enrico Villa commented: "We are following an evolutionary process in the electronics sector," observed Enrico Villa, "which in electronics means making headway in the field of function integration and miniaturization. As a result, in two to three years we will develop 0.5 micron CMOS [complementary metal-oxide semiconductor] technologies, and in a decade we will reach perhaps not the physical, but certainly the practical 0.3 micron limit for silicon." SGS-Thomson is therefore carrying out research on architectures that can emulate the animal brain. The goal is to implement synapses (the transmission of nerve impulses) in a thoroughly tested material such as silicon. At the same time, however, the knowledge that in 10 years it will be necessary to launch itself into composite materials or biochips is orienting the company's philosophy toward a completely new perspective for Italian industry: medium- to long-term research. SGS- Thomson is in fact a member of CIREF (together with Automa, Donegani, Elsag, and Sorin), an association that aims at fully developing the bioelectronics sector.

SGS-Thomson, a major company with 18,000 employees worldwide, is number 12 in the microelectronics sector. Its goal is to become one of the top 10 semiconductor (SC) manufacturers and thus ensure strategic independence for its shareholders. The company has consequently decided to invest 20 percent of its turnover in R&D.

Theme 2 Identification and simulation of industrial applications that can be optimized using neural architectures.

Theme 3 Amorphous silicon for reconfigurable structures. This line of research aims at developing technologies for the production of silicon as an amorphous material and possibly elements of inorganic semiconducting material of the III-V group, to be used individually and/or jointly.

Protein Engineering

Theme 4 The identification and characterization of proteins with electron transport and sensorial properties. The best known examples are molecules involved in cell respiration, cytochromes.

The research objective centers on the use of biophysical technologies. These include X-ray diffraction, Fourier transformation with bidimensional nuclear magnetic resonance (2Dtfnmr), recombinant DNA technologies, as well as the development of computerized "molecular modelling" techniques, integrated into an expert system to determine the three-dimensional structure of proteins. The use of 2Dtfnmr proves extremely interesting, as this technique, (destined, in fact, to replace X-ray crystallography, at least in biomolecules) permits a structural analysis of the proteins within the aqueous medium.

Theme 5 The identification and functional characterization of proteins involved in chemical oxidation-reduction reactions with a view to improving their functional properties).

Theme 6 The identification and functional characterization of proteins (produced by immunological cells) featuring antibody properties (in view of their prospective use as active components for electronic molecular recognition devices).

Theme 7 The identification and functional characterization of synthetic receptor proteins.

First-Generation Bioelectronics

Theme 8 Technologies and equipment for the construction of orderly layers designed for the production of electronic devices with a molecular function. The goal of this research is to develop electronic devices with molecular functions by studying the characteristics of orderly molecular structures arranged in films, through the use of high-resolution techniques such as tunnel-effect and atom-powered microscopes. In other words, this research is designed to develop construction methods of orderly biopolymer layers through self-organizing techniques. In order to obtain extremely stable polymers, researchers will use molecules derived from the microorganisms capable of surviving at 97° C that were recently isolated on the slopes of Vesuvius (archaeobacteria that can survive in extreme temperatures).

SGS-Thomson's Laboratories

It is certainly not possible to enter the laboratories. Raising two to three million dust particles would be terrible. Silicon wafers must be processed in an environment with a humidity level under 30 percent and at a temperature lower than 26° C. However, what makes things extremely difficult is dust, which, according to the "cleaning grades" established for the production of chips, absolutely must not exceed between one and 10 particles per cubic foot of air. In an open-heart operation, surgeons are far more tolerant: As many as 10,000 dust particles per cubic foot are freely allowed to whirl around in the operating room.

As Maria Grazia Prestini, head of the international press office, explained: "For this reason SGS-Thomson, with a progressive industrial approach, decided to establish laboratories for extremely advanced processing in that area of Asia, which until recently was regarded as a pool of cheap labor."

Thanks to the proverbially scrupulous nature of Asians, this strategy has proved successful. "In 1984," as M.G. Prestini pointed out, "we were the first to export the 'front end' of the production process to Asia, that is, the extremely advanced and complicated procedure of photoengraving silicon chips. Initially only the second part of the chip production process (the 'back end' or assembly), which calls for a larger workforce and fewer technological skills, was performed in Singapore or Malaysia. The success of this pioneer experiment prompted us to inaugurate a second production line there in 1988." SGS-Thomson ranks second to Philips in the European semiconductor sector and is involved in the EUREKA [European Research Coordination Agency] and JESSI [Joint European Submicron Silicon Initiative] projects. The company is also a leader in the rapidly expanding sector of smart power circuits, given its innovative capacity to combine signals and power in the same chip. The recent takeover of the British company Inmos has enabled SGS-Thomson to significantly penetrate the market for 32-bit microprocessors with the Transputer (a device that is particularly suitable for parallel processing applications). As of this year the company will also market a 0.8 micron chip developed by its VLSI laboratory in Agrate that uses MOS (metal-oxide semiconductor) technology.

Goals, Activities of Philips Electronics Lab

90WS0018B Paris INDUSTRIES ET TECHNIQUES in French 23 Mar 90 pp 58-61

[Article by Ridha Loukil: "Philips: The Lep Opens Up to the Outside World"]

[Text] For Philips, research goes hand in hand with manufacturing, wherever manufacturing may be. In France, research is entrusted to the Philips Electronics Lab (Lep), located in Limeil-Brevannes, in the Paris area. By separating research from manufacturing, Philips gives the facility the means to prepare the technological future of its French subsidiaries, far from manufacturing concerns. Jacques Bonnerot, president and general manager of Lep, justifies this independence by the need to maintain freedom of choice in research topics. "When we began to work on neuron networks," he recalls, "no one in the manufacturing divisions was interested. Now there are applications for it." Yet Lep does not stray far from the needs of the group.

The Importance of a Minimum of Disciplinary Studies

Basic research is voluntarily passed over in favor of the applied variety. "It is not our purpose to construct theories, but to exploit the findings of basic research so as to propose product projects to the manufacturing divisions. Each project brings together R & D teams, with precise objectives in terms of target dates and results." The Lep carries out three kinds of research: exploratory research expected to last 10 years, advanced research over 4- or 5-year periods, and predevelopment research in support of product divisions. The bulk of the work, however, benefits the second category first of all, and then the third. Maintaining a balance between development dictated by market needs and disciplinary studies beneficial in the long and medium terms is a continual concern of Jacques Bonnerot. "It is important to conduct a minimum of disciplinary studies: neuron networks, growth of 3-5 materials, and so on. Otherwise we would be less attractive to young people and would lose our R & D lead. It is through disciplinary studies

that we determined the coder and decoder algorithms for future high-definition television." The Lep's research focuses on 3-5 class materials, components, and systems. As research progresses, findings become increasingly relevent to applications. Though integrated opto-electronics is still at the exploratory research stage, a 1.3 μm detector is fully developed. Other devices (couplers, attenuators, beam deflectors) are being readied for hyperfrequency applications. Likewise, microwave integrated circuits of gallium arsenide are entering the application stage, where they will be miniaturized and their frequencies boosted. A 15-GHz phase modulator is already used by TRT [expansion unknown]. The developments are based on high-mobility electronic transistors, with grid lengths of 0.5 μm. While this technology is being transferred to the foundry for small-scale production, researchers are moving on to 0.25 μm technology which will make it possible to go up to 60 GHz. An analogous downstream movement is seen in ultrasound applications. A 3D echography system is expected to move into clinical evaluation this year. For use in medical diagnostics, it recreates the image in the zone studied (breast, fetus) in 3 minutes. A second prototype with an acquisition time of 4 minutes, instead of the 15 of the existing system, is under development. There are plans to market it in 1 or 2 years.

These projects are carried out in conjunction with the group's manufacturing companies: RPIC [expansion unknown] for high-definition television, TRT for Hertzian beams and 3-5 components, and PUI [expansion unknown] for ultrasound....

Outside Contracts Provide 10 Percent of Budget

But Jacques Bonnerot is ready to collaborate with other manufacturers—provided the partner is not a direct competitor of Philips or has an agreement with the Dutch group. "World competition is such that manufacturers with common interests must now combine forces to move things forward in Europe." A sentiment which matches perfectly the European programs in which the Lep participates: high-definition television, the Pygmalion project on neuron networks in Esprit II, and Oscar and CMC on integrated opto-electronics in the Race program.

The Lep is the leader of the Oscar project by virtue of its mastery of techniques such as organometallic epitaxy or ionic etching. Optical switching is studied here on gallium arsenide- and indium phosphide-based components.

Outside this institutional framework, the Lep works with the outside world in the field of integrated circuits. Its foundry is open to manufacturers, while certain highly integrated integrated circuits are manufactured under subcontracts. Outside contracts provide 10 percent of the budget, which is about 200 million French francs. This open door policy is encouraged by the Lep president and general director, anxious to prevent research from withdrawing into an ivory tower. "Besides bringing in money," he explains, "the contracts policy brings the lab into contact with the outside world, thereby honing its scientific and technical skills." This concern for quality is also expressed by an aggressive patent policy. The Lep files 60 patents a year, or 2.5 times more than it did 10 years ago. To further open his facility to industry, Jacques Bonnerot is interested in multidisciplinary projects to which participants bring their expertise in complementary fields. "Everyone has a great deal to gain from this type of collaboration," he believes. "We know how to do transducers, commands, signal processing, etc. If, during the course of working out applications, we need other expertise, such as mechanical or precision positioning, why not look for them on the outside? Likewise, more and more manufacturers want to integrate electronics into their products. Why not turn to us?"

This open door policy toward industry is matched by one vis a vis the world of teaching and research. The Lep keeps up special relations with the CNRS (National Center for Scientific Research), the universities of Montpellier and Lille, Sup-Telecom, and Normale-Sup. Collaborative efforts are being initiated with universities in Holland. These ties enrich the laboratory, in the "upstream" (basic research) direction, by bringing it advice and characterization methods it does not possess. They also attract young graduates, since 80 percent of Lep researchers come directly from the schools. To keep the staff young, transfer to industry is encouraged after 5 or 6 years of research. Conversely, researchers already experienced in industry bring a dose of reality to the research, by introducing notions of budget, time frames, and quality.

[Boxed Material] An R & D Network of 3,800 People

The Philips Electronics Laboratory (Lep), created in 1950, is a joint-stock company whose capital is held by Radiotechnique, RPIC, RTC-Philips Components, and the French Philips Corporation. Located since 1965 in Limeil-Brevannes, in Val-de-Marne, the Lep today employs about 350 people, of whom 130 are research engineers. The facility is part of a world-wide network embracing six other research centers: the Nat-Lab in Eindhoven in the Netherlands, the PRL in Redhill in Great Britain, the PFA in Aix-la-Chapelle and PFH in Hamburg in Germany, the BRL in Brussels in Belgium, and the NAPL in Briarcliff-Manor in the United States. In all, Philips has 3,800 people involved in research, on which it spends approximately one percent of its sales revenues (171 billion French francs in 1988). The Eindhoven center is by far the biggest, with nearly half the group's research capability. The two German laboratories are being regrouped to Aix-la-Chapelle. Establishment of a facility in Japan is not out of the question, inasmuch as the Dutch group already has a manufacturing company, Mec Components, a 35-65 percent joint venture with Matsushita, there. Because, for Philips, research goes hand in hand with establishment of a research facility. Its goal is to prepare the technological future of manufacturing on site. This is what explains its

decentralized structure which, on the Old Continent, reaffirms the group's European vocation. Liaison committees handle the relationship between each research center and associated manufacturing facilities. Likewise, committees put the different Philips laboratories in touch. Worldwide, research is coordinated by the group's executive committee.

SCIENCE & TECHNOLOGY POLICY

FRG: BMFT Subsidy Program for Microsystems Announced

90MI0166 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No. 521, 19 Feb 90 pp 2-4

[FRG Ministry of Research and Technology Guidelines on Indirect- Specific Subsidies for Research and Development Projects under the Microsystems Engineering Research Program (RL MikroSys P), 2 February 1990]

[Text]

Contents

1. Purpose of Grant

The federal government has introduced a priority subsidy program on microsystems engineering as part of its information technology "concept for the future." The program is designed to help companies introduce microsystems technology and exploit the opportunities that it brings.

Microsystems engineering means the coordinated application of microcircuitry and systems engineering to create the peripheral components and subsystems required by the market.

The need to maintain competitiveness and the market demand for new, more efficient products with increasingly shorter life cycles exert a constantly increasing pressure on companies to modernize. The demand is for increasingly intelligent products, capable of acquiring and evaluating data, and performing the appropriate actions.

The solutions provided by microsystems engineering fulfill this requirement and therefore have a practically unlimited range of uses in products in many different areas of application (e.g., environmental, safety, medical, communications, traffic, manufacturing, and process or domestic engineering).

As small and medium-sized firms have a limited capability to apply the technical options presented by microsystems technology, they are the chief concern of the microsystems engineering subsidy program.

Indirect-specific funding for the development of miniaturized and intelligent systems is one part of this Ministry of Research and Technology subsidy program.

Grants will be awarded in accordance with these guidelines and the preliminary administrative provisions as per Articles 44 and 44a of the Federal Budgetary Regulations.

Indirect-specific subsidies are subject to a deadline (see 7.2). The applicant has no guaranteed right to a grant. The decision is made by the adjudicating board at its discretion in light of the available budget funds. Should the number of applications exceed the federal funds available, the applications will be considered in the chronological order in which the detailed proposals containing all the requisites for adjudication are submitted to the project manager (see 4.1).

2. Projects Eligible for Grants

Nonrepayable grants will be awarded for R&D projects.

2.1 Processes for introducing microsystems technology will be funded on the basis of working prototypes developed for the following

kinds of microsystem:

2.1.1 Development of sensor elements and/or actuator elements, including microsensors and/or actuators having systems capability, when:

- Techniques involving micromechanics, integrated optics, fiber optics, ceramics, thick or thin films, or semiconductor technology are used to produce sensor elements, or
- Techniques involving micromechanics, piezoelectric and magnetostrictive materials technologies, or semiconductor technology are used to produce actuator elements.

2.1.2 Development of any type of information technology microcomponents for general applications using combinations of the microtechnologies listed in 2.1.1.

The term "combination of microtechnologies" is not used here to mean the mere accumulative assembly of components produced in different technologies to create a product; it means using several technologies within a systems engineering framework to manufacture a product. Each case requires its own application-specific adaptation of the various technologies involved to one another.

2.1.3 Microsensors having systems capability, using commercial sensor elements, i.e., microelectronics-compatible, miniaturized sensors with intelligent signal preprocessing for standardizing the sensor signal integrated into the sensor housing.

2.1.4 Small and microactuators having systems capability, for uses in measurement and control engineering, using commercial actuator elements, i.e., actuators with intelligent selection for processing standardized microelectronics-compatible control signals integrated into the actuator housing.

2.1.5 Microelectronic signal processing components having systems capability, for uses in measurement and control engineering as intelligent links between (micro) sensors and/or (micro) actuators and the operator or overriding level of an information technology system.

With points 2.1.3 through 2.1.5, funding is made available for the development of basic components for measurement and control in microsystems. Commercially available elements may be used as sensor and actuator elements under 2.1.3 and 2.1.4. The signal processing components and the actuator selection or signal preprocessing systems must involve the use of surface assembly techniques, thick or thin film hybrid techniques, or even more extreme miniaturization, such as semiconductor techniques for developing customized circuits (ASICs).

Two successive phases may be funded:

2.2 Preliminary phase

Before development work begins on a project under 2.1, a preliminary phase may be funded to enable a company with only a rough idea for a prototype development to:

- Carry out preparatory market research on the demand among potential buyers or users;
- Select appropriate technologies;
- Render the technical concept viable;
- Determine what organizational structures and arrangements for cooperation are best suited to developing the prototype and preparing it for production.

This preliminary phase must be concluded within six months, with the concept confirmed by preliminary studies, worked out in detail, and ready for appraisal, and with a detailed performance specification for the subsequent development.

2.3 Development phase (prototype development)

The development of prototypes, including their production and testing, may be funded as a development phase, if a project complying with 2.1 is chosen and concluded within two years and six months.

Projects mainly involving work directed exclusively toward producing and testing prototypes or further developing or revising existing prototypes will not be funded. Pilot production runs and preparations for them will not be funded.

Applications for development phase funding are not conditional upon an application having been made for a preliminary phase. However, if a preliminary phase is approved, the development phase may not begin before the conclusion of the preliminary phase.

3. Companies Eligible for Grants

Legally independent commercial manufacturing companies with their headquarters and business offices in the FRG including (West) Berlin, an annual turnover not exceeding 1 billion Deutsche marks [DM], and which have their own development and production facilities may apply for indirect-specific subsidies. They must also demonstrate that they have already achieved an annual turnover of at least DM100,000 with products that exploit information technology.

Joint venture companies formed by at least two eligible companies may apply for funding for cooperation projects designed to provide technical services that are not yet marketable and that relate to the development and manufacture of prototypes as per 2.1.1 and 2.1.2.

4. Conditions for Grants

4.1 The prototype development planned must include one of the development topics listed under 2.1 and comply with the limitations defined therein. A concept set out in detail and ready for adjudication must be submitted for the development phase.

The development of conventionally designed systems (printed circuit board technology) will not be financed.

4.2 The company must carry out the project in the FRG (including West Berlin). Similarly, the microsystems developed under the project must be produced mainly in the FRG (including West Berlin).

4.3 Ineligibility for Funding R&D projects will not be funded if they are already receiving subsidies under other technology-oriented FRG, Land, or European Community programs, or if they have been commissioned by third parties.

5. Type, Extent, and Amount of the Grant

One preliminary phase may be funded for every development phase.

5.1 Amount of the Grant

The grant covers 40 percent of the costs listed under 5.2. The maximum grant per company (upper limit) for the duration of the funding scheme totals:

- DM400,000 for developing prototypes of microsensors having system capabilities and using commercial sensor elements (2.1.3), small and microactuators having system capabilities and using commercial actuator elements (2.1.4), and miniaturized signal processing components having system capabilities (2.1.5);

- DM800,000 for microsensors having system capabilities and involving sensor elements developed by the applicant, microactuators having system capabilities and involving actuator elements developed by the applicant (2.1.1), and prototypes involving information technology microcomponents developed by the applicant in combination with specified microtechnologies (2.1.2).

An advance of up to DM50,000 on these sums may be requested for a preliminary phase. If a company has first carried out a prototype development funded under 2.1.3, 2.1.4, or 2.1.5, it may be awarded the difference between the initial grant and DM800,000 to fund another prototype development as per 2.1.1 or 2.1.2 within the duration of the indirect-specific subsidy program. Similarly, a company that has first carried out a prototype development funded under 2.1.1 may be funded for a further prototype development under 2.1.2 within the upper limit and duration of the indirect-specific subsidy program.

An eligible company and a joint venture company of which it is a cofounder may undertake a prototype development as per 2.1.1 or 2.1.2 in the form of a cooperation project. Each will make a separate application for a grant for the costs that it incurs while carrying out the project. The upper limit of DM800,000 applies to both of these applications, but the combined total may not exceed DM1.2 million. The cooperating partner of the joint venture of which it is a cofounder will also undertake to cover the joint venture's own contribution to the cost of the cooperation project. The joint venture may participate in and receive grants for up to four prototype developments simultaneously.

The maximum grants stated are the upper limits for the total of any one company's preliminary and development phases. Financially linked companies, where one holds 50 percent or more of another, shall be treated as a single company for the purposes of the upper grant limits.

5.2 Calculation of the Grant

The following costs incurred as a result of the project (without

sales tax), taking the preliminary and development phases together, may be charged:

- Directly attributable and demonstrable personnel costs, at a flat rate of DM12,000 per man-month for highly qualified, permanently employed, in-house personnel, such as physicists, chemists, engineers, technicians, and marketing or project managers. The flat rate is to cover individual personnel costs, ancillary personnel costs, overhead, travel expenses, and material costs. Training hours will be calculated as personnel hours. A man-month consists of 160 productive man-hours pertinent to the project. If fewer hours per person and per month are worked, the flat rate is reduced proportionally; the flat rate cannot be raised even if more than 160 hours per person per month are worked;
- Individual costs for R&D contracts, technical consultancy, preparatory market research undertaken to determine the demand among potential buyers or users, and for consultancy and training contracts to raise qualifications and make the necessary organizational changes, not exceeding the level of the chargeable in-house personnel costs;
- Proportional linear depreciation or leasing installments on laboratory equipment and machinery, production machinery, and CAD/CAE [computer- aided design and engineering] tools (hard- and software) acquired in the preliminary or development phase for the development, production, and testing of the prototype, funded and used for these purposes. These costs may not exceed the level of the chargeable in-house personnel costs. Depreciation will be calculated over five years.

For the purposes of calculating the costs eligible for grants, the preliminary and development phases of a prototype development will count as a single project.

6. Other Rules Governing Grants

6.1 The award of grants is subject to special collateral clauses (NBest MikroSys P).

6.2 Circumstances having a bearing on eligibility for a grant within the meaning of Article 264 of the Penal Code must be explained in detail in the application.

7. Procedure

7.1 Applications for indirect-specific research and development project subsidies under the microsystems engineering subsidy program must be made on the appropriate forms and addressed to the VDI/VDE Information Technology Center GmbH, Budapester Strasse 40, 1000 Berlin 30. Application forms may be obtained from the same address.

7.2 Applications may be submitted from the date of publication of these guidelines until 31 October 1993. The date of application is considered to be the date when the fully documented application, ready for adjudication, arrives at the VDI/VDE [Association of FRG Engineering/Association of FRG Electrical Engineers] Information Technology Center in Berlin. Grants will only be made for projects that begin no earlier than the month of application. Projects beginning after 1 December 1993 will not be eligible. The balance will be settled over the following years.

7.3 The Federal Minister of Research and Technology will decide whether or not to award a grant. The applicant will be notified of the decision by the VDI/VDE Information Technology Center.

7.4 The period covered by the grant will be laid down in the decision awarding the grant. Costs relative to the project will only qualify for the grant if they are incurred within that period.

The beginning of the period covered by the grant may be set at the beginning of the month in which the complete application is received by the project leader (with an approximate concept for a preliminary phase or a detailed concept ready for adjudication for a development phase). The project leader will determine whether or not the application is complete.

7.5 The grant will be paid according to the "Collateral Clauses on Indirect-Specific Subsidies for Research and Development Projects Under the Microsystems Engineering Subsidy Program (NBest MikroSys P)." These collateral clauses govern in particular the application for a grant, the evidence to be provided as to its use, and the examination of this evidence.

7.6 The Federal Minister of Research and Technology has appointed the VDI/VDE Information Technology Center to administer the subsidy program as project leader.

The project leader's special responsibilities are providing information about the funding scheme, checking the applications, advising on funding decisions, administering the funding, processing requests for payment, checking the interim and final evidence of use, and corresponding with the companies concerned. The project leader is entitled to obtain information from the companies about the applications and the administration of the subsidy. The project leader is bound by the laws of confidentiality.

7.7 Unless otherwise provided in these funding guidelines, the preliminary administrative provisions as per Articles 44 and 44a of the FRG Budgetary Regulations shall apply to the approval, payment, and settlement of grants, to eivdence of use and how it must be checked, and, if necessary, to the revocation of awards and the recovery of payments already made.

8. Entry into Force

These guidelines shall enter into force on the day following their publication in the FRG Gazette.
On behalf of the FRG Minister of Research and Technology Dr. Lorenzen

SUPERCONDUCTIVITY

Italy: EC Superconductivity Projects Coordinated in Genoa

90MI0179 Milan ITALIA OGGI in Italian 22 Mar 90 p 43

[Text] A new EEC initiative has recently been approved. The initiative is designed to promote research projects on high-temperature superconductivity by establishing a network of laboratories that will be coordinated on the basis of specific research programs. Genoa has been selected as the coordinating center for these activities, while laboratories in Italy, France, the UK, FRG, Belgium, and Switzerland will take part in research projects on specific topics. These topics were discussed during the first meeting held at the Interuniversity Consortium for the Physics of Matter in the Genoa Research Area.

Superconductivity is the property of some materials to convey electric current without offering any resistance when cooled at extremely low temperatures. However, the processes used to cool the materials (which have already been used for some industrial and medical applications) are very expensive. The discovery in 1986 by Alex Mueller and George Bednorz of the IBM laboratories in Zurich (winners of the Nobel Prize for physics) of new materials that become superconductive at higher temperatures than traditional materials has created the prospect of a major technological revolution in the energy, transport, and microelectronics sectors. The goal is the large-scale production of superconductive equipment and materials that do not require expensive cooling (or do not need to be cooled at all). This equipment would consequently offer the opportunity to achieve technological and applications objectives that would otherwise be impossible with traditional materials. After the enthusiasm aroused by this discovery and the rapid succession of promising results, research on superconductivity has continued at a slower pace and with more realistic objectives in various laboratories in the United States, Europe, and Japan, far from the press.

"Research is proceeding well and the results are encouraging," stated Carlo Rizzuto, project coordinator. He explained that the project had been submitted to the EEC by the European Society for Research on Materials: "The network will focus primarily on the study of methods designed to increase current density in materials, that is, the amount of current conveyed per surface unit. This is essential in obtaining applications."

Rizzuto continued: "Each laboratory will concentrate on its strong points. The centers located in Karlsruhe, Geneva, Cinisello Balsamo, and London will be involved in cable development. Genoa and Grenoble will study current conveyance properties. Parma, Rome, and Genoa will concentrate on physical-chemical characterization. The various fields of study will be complementary, and the results will then be shared."

According to Rizzuto, who will examine the proposals presented by the various centers by the end of May, the funding required to operate the network will be between 500 and 800 million lire per year, for an initial three- or four-year period.

TECHNOLOGY TRANSFER

Italy: Italtel, USSR Sign Telecommunications Accord

90MI0183 Milan NOTIZIE ITALTEL in Italian Feb 90 p 11

[Article by Laura Sipala: "Lots of News on the Eastern Front"]

[Text] Italtel is starting to reap the fruits of contacts that were established years ago with the East Bloc countries. Its first agreements with the Soviet Union and Bulgaria are now in their final stages.

On 30 November 1989 Guiliano Graziosi and Salvatore Randi, managing directors of STET [Turin Telephone Finance Company] and Italtel, signed an agreement with Krasnaya Zarya, the principal Soviet telecommunications company. This agreement provides for the establishment of a joint venture for the supply of numerical switching exchanges. According to a preliminary estimate, production should total between 1.5 and 2.5 million subscriber lines per year.

The subscriber line should meet the USSR's need to develop its telecommunications system both on an industrial scale and in terms of service and performance. The Italian-Soviet joint venture will provide most of the lines required for this purpose. Other fields of cooperation as well as export opportunities are also being considered.

The monetary and financial aspects of the agreement are currently under study. The Soviet economy does not appear to have the monetary resources that are necessary for major investments at this time. Therefore, the launching of wide-ranging programs is undoubtedly linked to the USSR's methods of payment in hard currency. In addition, the agreement will have to conform to current regulations on the export of high technology products.

Italtel and Krasnaya Zarya are already working on adapting the subscriber line to the Soviet telephone network. A subscriber line exchange will be delivered in the near future for official approval.

From Europe to Japan

On 22 December 1989 another step forward was made at a meeting held in Milan between Vladimir Evsees, general manager of Krasnaya Zarya, and Salvatore Randi. At the meeting, the management boards of the two companies committed themselves to requesting the Soviet Electronics and Communication ministries to accelerate the final stages of the agreement.

Italtel has also taken part in a feasibility study in the Soviet Union on optical fiber telecommunications through the STET group, together with Western and Japanese managers and the Soviet Ministry of Communications. This system would connect West Europe with Japan by crossing the Soviet Union. Italtel is interested in supplying the optical fiber transmission devices and in defining the system. The project would involve three to five years' work and a financial commitment of approximately half a billion dollars. The consortium is called Trans-Soviet Line Development Corporation (TSLDC) and includes STET, the American company U.S. West, KDD [expansion unknown] from Japan, British Telecom, OTC [expansion unknown] from Australia, the FRG Bundespost, the Danish company Great Northern Telegraph, Telecom Denmark, and the Soviet Ministry of Communications.

The First Exchanges

Last September STET presented its companies in Moscow with an exhibition of its products and services as well as a series of technical seminars. Programs involving Telespazio for satellite communications in case of natural disasters, and SEAT [Telephone Directory Publishing Company] for the transfer of editorial know-how in the field of telephone directories (there are currently no directories in the USSR) were also mentioned. Negotiations for the supply of a preliminary group of nine subscriber line exchanges for a total of 60,000 equivalent lines are also close to being concluded in Bulgaria, a country committed to modernizing its telecommunications network.

A memorandum of understanding was signed in Milan on 24 November by Salvatore Randi and Nikola Monov, general manager of Telecom, the Bulgarian institute that handles telecommunications negotiations abroad. This agreement provides for a close collaboration between Italtel and Bulgarian management institutes and companies for the development of joint industrial initiatives. The first international subscriber exchange will also be inaugurated in Albania at the end of March. Representatives from the Italian PTT [Post, Telegraph, and Telephone Office] will attend the ceremony.

TELECOMMUNICATIONS R&D

CSSR: Overview of Fiber-Optic Cable Production at KABLO DECIN

90WS0001A Prague TELEKOMUNIKACE in Czech No 2, Feb 90 pp 33-34

[Article by Eng Vaclav Keller: "Production of Fiber-Optic Cables at KABLO DECIN"]

[Text] KABLO DECIN is one of the oldest producers of cables in Czechoslovakia. This year, it will celebrate its 80th anniversary of uninterrupted cable production. After 1945, the plant specialized in the production of communications cables. It produces telecommunications cables with copper cores for local and long-distance networks. For local networks, cables are produced with plastic as well as air-paper insulation having diameters of 0.4, 0.6, and 0.8 mm. For long-distance networks, cables are produced with air-paper insulation having core diameters of 0.9 through 1.4 mm and coaxial cables having dimensions of 1.2/4.4 and 2.6/9.5.

Effective November 1988, KABLO DECIN began producing fiber-optic cables. Currently, fiber-optic cables having multiple fibers are being produced. Cables with PCS-type silicon-polymer fibers with graduated indexes of refraction are intended for the transmission of information over short distances—up to 1,000 meters. They are, therefore, not considered for use in communications. Optical cables with GI-type fibers with a parabolic diameter of the refraction index make possible transmission of information over distances up to 10 km without repeaters. These attainable transmission distances are already suitable for utilization in communications. KABLO DECIN, therefore, designed its cables from GI fibers in such a way that they are usable as long-distance cables, as well as for use in local telecommunications networks.

Telecommunications cables made of GI fibers are produced at Decin with the following parameters:

Optical Attenuation	α at 850 nm	α at 1,300 nm
Class	(dB/km)	(dB/km)
I	α = or < 3.5	α = or < 1
2	α = or < 4	α = or < 1.5
3	α = or = or < 10	α = or < 2
Bandwidth	β at 150 nm	β at 1,300 nm
Class	(MHz/km)	(MHz/km)
I	β = or > 600	β = or > 800
II	β = or > 400	β = or > 600
III	β = or > 150	β = or > 400

From these basic parameters stems the suitability for using optical cables in the following levels of the telecommunications network (based on considerations abroad and those made by the Research Institute for Communications in Prague):

Network Level	PCM 1st Class	PCM 2d Class	PCM 3d Class	PCM 4th Class	PCM 5th Class
Subscriber	x	x	x		
Local		xy	xy	xy	
Central		xy	xy		
Long-distance			yz	yz	yz
Number of voice channels	30	120	480	1,900	7,680
Velocity of transmission (Mbit/s)	2.048	8.448	34.368	139.264	557.056

x—optical cables made of GI fiber, λ = 850 nm

y—optical cables made of GI fiber λ = 1,300 nm

z—optical cable with single fiber, λ = 850 and 1,300 nm

Design and Production

On the basis of an agreement with the Research Institute of Communications and with the Communications Assembly Enterprise, KABLO DECIN has been producing fiber-optic cables since 1989 in a single-fiber version, a 2-8-fiber version, and an 8-12-fiber version. The single-fiber version, the Model GASY 1 x 50/125, is shown in Figure 1. The cable is intended for connecting multiple-fiber cables between the terminal connector and the optical switchboard. The eight-channel version of the type GH_pOKE 8 x 50/125 cable is shown in Figure 2. It is produced in a 2-8-fiber version. If fewer than eight optical transmission elements are required, the fibers are replaced by full polyethylene inserts. Upon customer request, copper wire (diameter 0.6 mm), insulated by PE, can be used as an insert.

The 12-fiber version of the GH_pOKE 12 x 50/125 cable is shown in Figure 3.

It is also possible to order cables having 10 optical fibers. Two fibers are replaced with PE inserts or with a polyethylene-insulated copper strand with a diameter of 6 mm. Multiple-fiber versions are produced for transmission of information with the λ value being 850 nm and 1,300 nm. For transmission at wavelengths of λ =

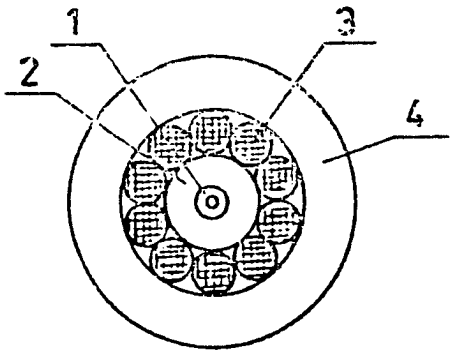

Figure 1. Single-fiber version of fiber-optic cable produced by KABLO DECIN, type GASY 1 x 50/125.

Key:—1. GI 50/125-micrometer optical fiber with primary protection of 250 micrometers—2. Tight-fitting secondary protection 0.9—3. Nonmetallic drawing elements—4. PVC cover

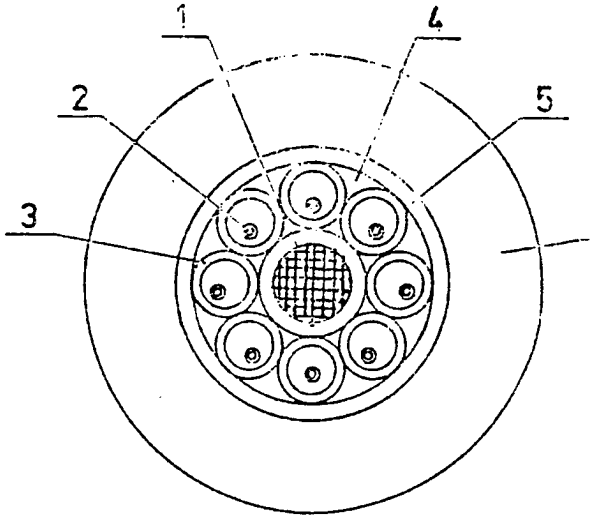

Figure 2. Eight-fiber optical cable.

850 nm, the secondary protection tubing and the interfiber spaces need not be filled with special materials which form barriers against the spread of water vapor in the cable.

Cables intended for the transmission of information over wavelengths of 1,300 and 1,550 nm are produced, as a matter of principle, with the interfiber spaces filled and a layered aluminum-polyethylene coating is also suitable and forms a thorough water barrier.

The basic version for Czechoslovak communications is such that the center of the cable is formed by a steel cord which is an element preventing the stressing of the fibers during unavoidable manipulation of the cable. The coat is layered and made of PEA1PE strip and a polyethylene outer coating.

Multiple-fiber cables are produced for special purposes even in dielectric versions.

The central drawing element is made of impregnated glass fiber. The coating in this version is only polyethylene. The production of the cable is discernible from the listed designs. KABLO DECIN purchases optical fibers from VUSU at Teplice—fibers which are already equipped with primary protection made of acrylate. The external diameter of such a fiber with primary protection is 250 nm. At Decin, we provide the optical fibers with secondary protection. In the case of a single fiber cable, this protection is tight-fitting. In the case of a multiple-fiber cable, we produce secondary protection in the form of a free tube which can be filled either with a special gel or may contain air.

Individual fibers provided with secondary and primary protection are graded, using the SZ system, around a carrier drawing element in a production braiding operation.

The last production operation is the filling of the interfiber space with special vaseline, the placing of the cushion made of water-blocking textile, the placing of the PEA1PE strip for the layered coating, and the extrusion of a PE or PVC coat.

From the standpoint of the demanding nature of the design of the cable and depending on the number of necessary production operations, the production of optical cables appears to be relatively simple. However, the production technology for optical cables is substantially more demanding than the technology for cables with copper cores. The optical core is relatively brittle and weak. The regulation of drawing in uncoiling or coiling fibers must be assured with an accuracy of 0.1 newton. The optical fiber located within the tube containing the free secondary protection must be 0.1 percent to 0.15 percent longer than the length of the secondary protection and the length of the cable. A smaller extra length within the tube can cause a rupture of the fiber during subsequent production. More overlength within the free secondary protection area can cause additional bends and result in increased attenuation during cable temperature changes.

The cable must be so designed and manufactured that its design can fully compensate for the differentiated thermal extension of silicon fiber, the plastic material used for secondary protection, the terminal draw elements, and other materials. To master this and tens of other technological problems, perfect production equipment is essential. KABLO DECIN purchased relatively good technological equipment from the Austrian firm of Rosendahl and the Swiss firm Swisskap. Each of the production lines is equipped with a number of analog and digital regulating loops. Each line is controlled by an independent control computer.

Thanks to the good technological equipment and the initiative approach brought to bear by the working collective at KABLO DECIN, it was possible to master

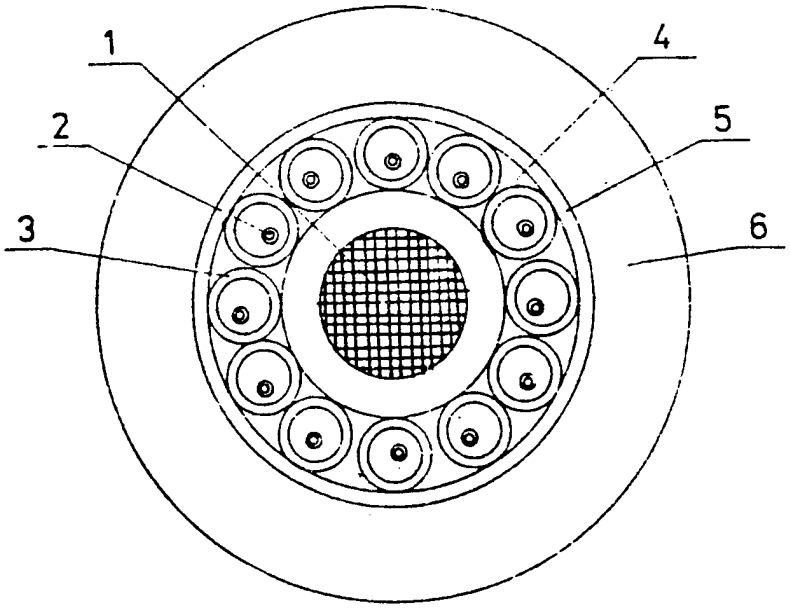

Figure 3. Twelve-fiber optical cable produced by KABLO DECIN.

Key:—1. Metallic or nonmetallic drawing elements—2. GI 50/125-micrometer optical fiber with 250-micrometer primary protection—3. Empty or filled loose-fitting secondary protection—4. Empty or petrolatum-filled cable core—5. Water-blocking circuit insulation or aluminum foil backed on both sides with a copolymer—6. Polyethylene coating

the production of optical cables in the relatively short time—cables made of GI fibers—at a very decent level. The transmission and mechanical parameters exceed the recommended standards of the CEMA countries and fulfill the recommendations of the CCITT.

For 1990, KABLO DECIN is preparing the production of an optical cable in a deposit-type version. The first PE coat will be overbraided with two steel ribbons. These two steel ribbons will then have a second PE coat pressed on. We anticipate that this version will result in relatively significant savings on the part of users. It will be possible to place this cable directly into suitably arranged trenches in less-exposed environments.

We shall expand the production assortment in 1990 also by the addition of self-supporting optical cables which could be used as overhead wiring.

We are also preparing the production of optical cables having up to 24 fibers. The design of these cables will be similar to the design of the 12-fiber cables. The doubling of the number of fibers in the cable will be accomplished by increasing the diameter of the free secondary protection tubing and by depositing two fibers into one tube. The fibers will differ from each other by being of different colors.

For the years 1991 and 1992, we are preparing the production of cables having a single fiber and expect to increase the number of fibers up to 120 fibers in one cable.

Parameters of Fibers and Cables	
Type of fiber	Gradient
Diameter of fiber core	50 +/- 3 nm
Diameter of silicon fiber coating	125 +/- 3 nm
Diameter of primary protection	250 +/- 15 nm
Numerical aperture	0.20 +/- 0.02

Delivery Possibilities

KABLO DECIN delivers connectors for fiber-optic cables to facilitate their connection in cable tracts. Together with the Communications Assembly Enterprise in Prague, KABLO DECIN developed TYP GS 24 connectors which facilitate the connection or termination of fiber-optic cables having from 2 to 24 fibers. Within the connector, the cables are welded together during assembly, are strengthened, and are placed in that manner so as not to stress the fibers through drawing. Within the connector, each connected cable also has a reserve of fiber which facilitates the possible repair of the connector and reassembly.

At the terminal of the optical fiber, in the terminal connector of the GS type, the individual fibers of the cable are welded to the type GASY 50/125 single-fiber cables.

The other end of the type GASY terminal cable is already equipped with a Tesla Jihlava connector. KABLO DECIN provides Tesla Jihlava with GASY

cables measuring 1,000 and 2,000 meters in length. Tesla Jihlava then cuts the GASY cables into terminal strings measuring 2 to 100 meters in length. One end of this cable is equipped with a connector which is then inserted into the receptacle of the optical portion of the switchboard.

The placing of the cables, the assembly of connectors, and the attachment of the cable to the optical switchboard is handled by the Communications Assembly Enterprise in Prague. This enterprise also developed and delivers the necessary tools for assembly. It even developed and produces optical switchboards.

Electro-optical and optical-electrical converters are produced by Tesla Blatna.

Markings of Optical Cables

Lettering	
G	Cable containing optical fibers
A	(as a second letter) tight-fitting secondary protection
H	Loose secondary protection
H_p	Loose secondary protection filled with gel
O	Metallic carrier element with plastic insulation
S	Nonmetallic carrier element with plastic insulation
A	(as a fourth letter) longitudinal deposit of aluminum foil backed bilaterally with a plastic foil
K	Cable
Y	PVC coating
(P)	Cable core filled with petrolatum
Numbers	
First	Number of optical fibers in cable
Second	Diameter of optical fiber core
Third	Diameter of core wrapping
Fourth (Roman)	Class according to value of attenuation
Fifth (Arabic)	Class according to width of band
Sixth	Wavelength of radiation
Example of Marking	
1	GASY 1 x 50/125-1/1/850
2	GH_pOKAE (P) 12 x 50/125-1/1/1300

Type of Cable	Single-Fiber	8-Fiber	12-Fiber
Maximum stress during drawing (N)	300	1,200	2,000
Minimum radius of bend (nm)	40	100	120
Nominal mass (kg/km)	19	148	200
Temperature during assembly (°C)	0-50	0-50	0-50
Storage temperature (°C)	-25 to+55	-25to+55	-25to+55
Nominal diameter of cable (nm)	2.8	10	12
Lengths produced (m)	500	1,000	1,000

The replacement of communications cables having a copper core with fiber-optic cables represents a truly revolutionary innovation in the production and utilization of communications cables. Currently, the key world producers have either completely halted or significantly restricted their production of copper communications cables. A substantial portion of the transmission of information is being realized with fiber-optic cables. KABLO DECIN is prepared to realize this innovation rapidly even in Czechoslovakia. It should bring about important savings in metals, energy, and quality improvements in communications services. In the event of actual series production and series application of fiber-optic transmissions, fiber-optic communications would also become cheaper.

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